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# MUNICIPAL ENGINEERING

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DEVOTED TO THE IMPROVEMENT OF CITIES

PAVING, SEWERAGE, WATERWORKS,
STREET LIGHTING, PARKS, STREET CLEANING,
GARBAGE DISPOSAL, PUBLIC SANITATION, BRIDGES.

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# MUNICIPAL ENGINEERING

VOLUME XXV NOVEMBER, NINETEEN HUNDRED THREE NUMBER FIVE

## METHODS AND RESULTS OF MUNICIPAL IMPROVEMENT.

### CONVENTION OF A. S. M. I.

The American Society of Municipal Improvements held a very successful convention in Indianapolis on Oct. 20, 21 and 22. The society has now gained the attention of the municipal officials of the country and has demonstrated its value as an aid to them in preparing for and discharging their duties.

The delegates to its conventions may be roughly divided into three classes; those who have reasonably permanent tenure in their positions and come each year for the mutual benefit of themselves and their fellow members, those who recognize the value of the conventions and attend for the years they are in office, but who continue their attendance but a few years because they are rotated out of office, and those of greater or less permanence of official tenure who feel able to attend only when the convention is held in their own neighborhood.

The first class forms the permanent nucleus which gives to the society its satbility and is responsible in large part for its high character. The other two classes aid very largely in the support of the society and so far as attendance is concerned, it depends upon them. No very strong effort has been made to secure large attendance at any convention, and the attention of the officers of the association might well be devoted to the formulation of some plan for extending the knowledge of the value of the society. This is all that is necessary to increase the attendance largely and so extend the great influence of the society for good. Some effort of this sort was made by the local committee for the Indianapolis meeting with sufficient success to show what concerted and continued effort might accomplish.

Many delegates arrived on Monday or early on Tuesday and spent the morning in inspecting street railway and sewer constructions and in getting a birdseye view of the city from the Indiana Soldiers' and Sailors' Monument, which is 284 feet in height and commands the city and many miles of surrounding territory.

The afternoon was devoted to the opening address and reports of officers and committees. The address of welcome was given by Frank E. Gavin, the president of the Commercial Club, in whose assembly room and building all the sessions of the convention were held. The response was by Vice-President G. M. Ballard of Newark, N. J., and was followed by the president's address by Charles H. Rust. This address is given with abstracts of most of the papers, elsewhere in this number of Municipal Engineering.

The secretary's and treasurer's reports showed receipts of $707.50 and a balance in the treasury of $193.25, an increase over last year, showing a satisfactory financial condition. Dues were paid by ninety-three members.

Sixty persons registered and six cities in Indiana and Illinois alone were added to the membership. Following is the list of names of those present:

Leslie V. Christy, secretary street and sewer dept., Wilmington, Del.

Alcide Chausse, inspector of buildings, Montreal, Canada.

T. Chalkley Hatton, chief engineer street and sewer dept., Wilmington, Del.

John C. Moore, mayor, Madison, Ind.

Fred Crandall, city engineer, Muncie, Ind.

C. D. Pollock, asst. engr. bureau of highways, Brooklyn, N. Y.

C. H. Rust, city engineer, Toronto, Ont.

S. Weil, Jr., bd. public service, Cincinnati, O.

George F. Harper, city clerk, Madison Ind.

James S. Vinson, prest. bd. of works, Newark, N. J.

George M. Ballard, com. bd. of works, Newark, N. J.

C. V. Baumann, com. bd. of works, Newark, N. J.
A. F. Eggers, com. bd. of works, Newark, N. J.
John B. Stobaeus, bd. of trade, Newark, N. J.
Ernest Adam, engr. st. dept., Newark, N. J.
E. S. Rankin, engr. sewer dept., Newark, N. J.
M. R. Sherrerd, engr. and supt. dept. of water, Newark, N. J.
William E. Greathead, secy. bd. of works, Newark, N. J.
John Jones, street commissioner, Toronto, Canada.
F. H. Woods, Alderman, Toronto, Ont.
E. S. Barrow, city engineer, Hamilton, Ont.
Emmet Steece, city engineer, Burlington, Iowa.

TREAS. F. J. O'BRIEN,
B. P. W. Oswego, N.Y.

George W. Tillson, ch. engr. bureau of highways, Brooklyn, N. Y.
A. Prescott Folwell, prof. civ. engineering, Easton, Pa.
E. A. Fisher, city engineer, Rochester, N. Y.
W. J. Stewart, asst. city engineer, Rochester, N. Y.
F. J. O'Brien, supt. pub. wks., Oswego, N. Y.
M. W. Murphy, councilman, Burlington, Iowa.
Fred Giddings, city engineer, Atchison, Kas.
Arthur A. Adler, American Road Roller Company, Chicago, Ill.
Charles C. Brown, consulting engineer, Indianapolis, Ind.
F. J. Phinney, supt. Rockford (Ill.) waterworks, Rockford, Ill.
William H. Rieman, city engineer, East Orange, N. J.
Henry Brueggemann, mayor, Alton, Ill.
E. E. R. Tratman, C. E., editor Engineering News, Chicago, Ill.
John N. McClintock, consulting engineer, Boston, Mass.
S. H. Gregory, Alton, Ill.
J. G. Schoeffler, Alton, Ill.
George S. Dickson, Alton, Ill.
W. K. Eldridge, civil engineer, Indianapolis, Ind.
W. B. Howe, city engineer, Concord, N. H.
Alfred Clark, comr. of highways, Concord, N. H.
Charles Krone, bd. of pub. service, Hamilton, O.
A. D. Richey, city engineer, Elwood, Ind.
Fred J. Kern, mayor, Belleville, Ill.
A. H. Bain, city atty., Belleville, Ill.
A. S. Hatch, city electrician, Detroit, Mich.
Arthur N. Talbot, prof. municipal engineering, Urbana, Ill.
A. F. Knotts, mayor, Hammond, Ind.
S. Brandy, bd. pub. works, Grand Rapids, Mich.
Barney Meyer, genl. supt., Grand Rapids, Mich.
J. N. Hazlehurst, chief engineer, Mobile, Ala.
B. E. Briggs, city engineer, Erie, Pa.
Robert E. Memain, consulting engineer, St. Louis, Mo.
G. H. Benzenberg, consulting engineer, Milwaukee, Wis.
G. A. Parker, supt. Keney Park, Hartford, Conn.
Harry H. Devereux, mayor, Springfield, Ill.
Nelson P. Lewis, chief engineer bd. of est. and app., Brooklyn, N. Y.
Frank H. Hamilton, city engineer, Springfield, Ill.
William Fortune, Municipal Engineering Co., Indianapolis, Ind.

The report of the Committee on Municipal Data and Statistics was read by Charles Carroll Brown, chairman. It stated that the collection of municipal data by U. S. government officials has been assigned to the census bureau in the new Department of Commerce and Labor, and that this bureau had been furnished with full information upon what has been done by the society. The formulation of plans and preparation of forms will be taken up by the department early in 1904. Upon recommendation of the committee the forms presented for consideration were referred back with instructions to confer with the government officials and others for the purpose of deciding upon forms for reports and collections of data which will agree in principle, and thus advance the cause of uniformity in municipal accounts and reports and in statistics, for which the committee and the society are working. Mr. John N. McClintock then read a paper upon "The Model City."

BROOKSIDE PARK, INDIANAPOLIS.

SHELTER IN BROOKSIDE PARK, INDIANAPOLIS.

The evening was occupied by a banquet at the Commercial Club, attended by the members and a number of citizens of Indianapolis. John W. Holtzman, the mayor of the city, presided as toastmaster, and speeches were made upon the effect of various factors upon the development of a city, that of the interurban railways being discussed by Arthur N. Brady, that of organizations of business men by John W. Kern, that of the city charter by Jacob P. Dunn, and that of the individual citizen, under the title "The Making of a City," by William Fortune. G. M. Ballard, vice-president, made clear the objects of the society; A. P. Folwell, second vice-president, spoke upon municipal sanitation, and Nelson P. Lewis gave some idea of the wonderful developments in New York City which are in progress. C. A. Kenyon and John L. Griffiths of Indianapolis also responded to calls.

At the session of Wednesday morning, G. M. Ballard of Newark, N. J., chairman, read the report of the Committee on Taxation and Assessment, and a paper upon "Municipal Taxation;" John Jones of Toronto, Canada, read the report of the Committee on Disposal of Garbage and Street Cleaning and a paper on the "Toronto Garbage Destructor," and A. Prescott Folwell read the report of the Committee on Sewerage and Sanitation and a paper on "Perviousness of Sewers."

The afternoon was given to a carriage drive about the city and to Riverside Park, the filter beds and pumping station of the Indianapolis Water Company. A convenient feature of the trip was the program of the route, prepared by the city engineer's department, giving full information about the various pavements and the various objects of interest under observation. Many expressions of good opinions regarding the pavements passed over were heard, particularly of the asphalt on Monument-place, Massachusetts-ave. and New Jersey-st., and the Kreodone wood blocks on Delaware and Meridian-sts.

The evening was filled with papers upon the various engineering features of Indianapolis, most of them illustrated by the stereopticon. They included descriptions of the paving system by J. B. Nelson, city engineer; the development of the Kreodone wood block pavement, by P. C. Reilly; the sewer system, by Charles Carroll Brown, former city engineer; the water system, by F. A. W. Davis, general manager; the central heating plants, by W. K. Eldridge, C. E.; the park system, by George Merritt, park commissioner, and the street railway system and interurban terminal plans, by Thomas B. McMath, the engineer of the Indianapolis Traction and Terminal Comvany.

Thursday was filled full of papers, the morning being devoted to lighting, waterworks and parks, and the afternoon to pavements. The report of the Committee on Electric Street Lighting was given by E. A. Fisher of Rochester, N. Y., chairman, who also read a paper on the "Street Lighting of Rochester." H. W. Hillman of Schenectady, N. Y., answered the question, "Have improvements in electric arc street lighting kept pace with other municipal improvements?" Austin S. Hatch of Detroit, Mich., explained his method of keeping "The Records of City Electricians." Morris R. Sherrerd of Newark, N. J., presented the report of the committee on Waterworks and Water Supply, and read a paper on the "Construction of Reinforced Sixty-Inch Concrete Conduits." G. A. Parker of Hartford, Conn., presented the valuable report of the Committee on Parks.

Prof. A. N. Talbot presented the report of the Committee on Review, which will appear in a future number of Municipal Engineering. The papers under the report of the Committee on Street Paving, which were presented by Nelson P. Lewis of New York, chairman, were as follows: "Maintenance of Asphalt Pavements in Rochester, N. Y.," by William J. Stewart, first assistant city engineer; "The Passing of the Cobblestone," by George W. Tillson of Brooklyn, N. Y.; "Recent Specifications for Wooden Block Pavements in New York City," by F. A. Kummer of New York; "Single Course Brick Pavement," by Fred Giddings of Atchison, Kas.; "Medina Sandstone Pavements in Brooklyn," by Clarence D. Pollock of Brooklyn; "Newark's Pavements," by Ernest Adam of Newark, N. J.; "The Construction of Warren's Bituminous Macadam Pavement," by C. A. Kenyon of Indianapolis.

The time of the convention was so thoroughly filled that several delegates remained until Friday to inspect the various points of interest named in the list prepared for the convention.

The program prepared by the President was more than usually valuable, especially upon the subject of pavements, for which portion of the program of the Committee on Pavements, Nelson P. Lewis, chairman, was largely responsible, and the resolutions, the daily papers and the members all pronounced the convention a memorable success. A delegate, who has attended all the conventions of the society, said that this was the most

successful convention the society has held.

An amendment to the constitution was adopted dropping from membership in the executive committee past presidents who have not retained continuous membership. A resolution was adopted providing for written discussions of papers presented, to be printed in the proceedings, under the charge of the author of the original paper and the secretary. Mr. G. H. Benzenberg of Milwaukee made a suggestion, which was received with favor, that the officers confer with the League of American Municipalities with reference to the two societies meeting at St. Louis next year at the same time.

The officers elected were:

G. M. Ballard, Newark, N. J., President.

A. P. Folwell, Easton, Pa., First Vice President.

Charles Carroll Brown, Indianapolis, Ind., Second Vice-President.

E. S. Barrow, Hamilton, Ont., Third Vice-President.

Financial Committee: Emmet Steece, Burlington, Iowa; B. E. Briggs, Erie, Pa., Alcide Chausse, Montreal, Canada.

## PRESIDENT'S ADDRESS.

*By C. H. Rust, City Engineer, Toronto, Can.*

When this society was formed ten years ago, there were many who doubted of its success, but I think we have proved that it has been a potent factor in bringing about improvements in municipal administration in all our cities and towns, and has resulted in a more frequent interchange of opinion between municipal officers, who are thus kept closely in touch with the most modern methods employed in all branches of municipal government. The various papers that have been presented at the annual meetings, and the discussions resulting therefrom, have been of a very high character. It is necessary that we should impress upon all municipalities the advantages derived from attending our conventions, and the importance and usefulness of this society, which are clearly demonstrated by reading the reports and discussions of our proceedings throughout the different years.

Although our membership roll has increased satisfactorily, the increase would have been much greater had it not been for the formation of similar organizations. At the convention held last year in Rochester the question of amalgamating with other municipal societies was discussed, but the consensus of opinion among the members was opposed to such a course. We might, however, consider the advisibility of holding our convention at the same time and place as the League of American Municipalities, which met in Baltimore during the first part of this month. This society, I understand, represents largely the legislative branch of our municipal government. Notices of our meeting were issued to the mayors and other municipal officers of all the large cities and towns in the States and Canada, inviting them to attend this convention and a number of the mayors replied to the effect that they had arranged to be present at the convention of the League of American Municipalities, and regretted their inability to attend both meetings.

Referring to the advances made in municipal engineering during the past ten years, the electric street railway system has been universally adopted by all cities and large towns and by means of interurban roads, cities, towns and villages have been brought in close touch with one another. Owing largely to the method of construction and the low cost of the right-of-way, interurban companies have been enabled to charge lower rates than the steam railway companies, with the resultant effect of so reducing the receipts of the steam roads that in many cases the running of local trains has been almost entirely discontinued. From the experience of the past ten or twelve years it has been found advisable to use a much heavier type of rail than was originally laid. The practice now in vogue is to lay the rails upon a solid bed of concrete, using iron tie bars, wooden ties being entirely dispensed with. Regarding the type of rail, when this matter is left to the decision of the city authorities, a grooved, girder rail is usually selected and experience has proved this to be the most satisfactory style of rail, especially upon paved streets. The street railway officials, however, prefer the T-rail, but it is found very difficult to maintain the pavement next the rails when this type is used.

Shortly after the installation of electric

roads it was discovered that, owing to the rails not being properly bonded, electrolytic action took place and in some cities serious damage has been done to water and gas pipes. The construction of the overhead trolley system has resulted in further aggravating the evil of overhead wires. The trolley wire is not as objectionable as the large number of feed wires which are required, and I am of opinion that all municipalities should now insist upon these wires being placed underground.

During the past decade the question of sewage disposal has been brought prominently before municipalities, and as a result of very extensive experiments, the method of precipitation by chemical means will probably be superseded by septic tanks and contact beds. Some of the large European cities have been experimenting for a number of years with this form of treatment and sufficient data have been obtained to warrant the construction of permanent works. Manchester was the first large city in England to adopt septic tanks and bacteria beds. The first cost is excessive, and unfortunately we have not sufficient information before us to arrive definitely at the annual cost, but it will probably range from $1.50 to $3 per million gallons. The great advantage of this system is the reduction in the amount of sludge to be disposed of and the high degree of purity that can be obtained by treatment upon contact beds after septic action. If a first-class effluent is not desired, septic tank treatment may be found sufficient. Every city, of course, is a special study in itself, and where suitable soil can be obtained at a reasonable cost, I am of opinion that land treatment after septic tank action will be found the most satisfactory method of disposal in this country.

Considerable progress has also been made in the method of constructing pavements and sidewalks. In laying pavements the question of freedom from noise, as well as durability, should be carefully considered, for in business centers property owners would prefer to pay more for a noiseless pavement, even if the lifetime is not so long. The ideal city pavement is block or sheet asphalt, or rectangular wooden blocks, treated with a preservative and laid upon a concrete foundation. The question of the advisability of requiring a long term of guaranty upon payments has been a source of discussion among engineers, many considering it undesirable to demand a guaranty of more than one year, while others are of the opinion that municipality is better protected and it is more probable that first-class material will be used, if a guaranty of five or ten years is required upon all pavements laid on a concrete foundation. As the tendency in cities and towns is to construct pavements of a costly nature, it has become customary to build narrower roads than formerly, in order to reduce the cost. In some cities the general width for residential streets is twenty-four feet.

One of the most important questions of the day, and one which has attracted great attention, not only from municipal officers but from the public generally, is the municipal ownership of public franchises. There is no doubt that every city should own and operate its own waterworks system and lighting plant. Unfortunately, during the past few years, if we may believe the public press, attempts have been made by capitalists, sometimes successfully, to corrupt both state and municipal corporations, for the purpose of obtaining public franchises, which condition of affairs would be entirely abolished if these were owned by the municipality.

A short time ago there was some discussion in the press upon the best method of appointing city engineers. In Canada the city council appoints the municipal officers during good behavior, which system has been found to work satisfactorily. This is also the universal custom in England and it appears to me to be preferred to the suggestion that the engineer be elected by citizens. I am of opinion that an official cannot be a good engineer and in addition devote his time to politics. One of the difficulties and drawbacks to the more successful administration of public affairs in American cities is the frequent change of officers, caused by the almost universal introduction of politics into municipal government. This is a matter much to be deplored.

The prevention of the lavish and unnecessary use of water in our cities is a matter deserving the earnest consideration of municipal officers. In European cities forty to fifty gallons per head per diem is considered sufficient for all purposes, and in some American cities 150 to 200 gallons per head per diem is used. Where water meters have been universally installed the result has been most satisfactory, the consumption being reduced sixty-five to seventy-five gallons per head per day. Although the first cost is very heavy, the saving effected more than compensates for the outlay.

BAYOU IN RIVERSIDE PARK, INDIANAPOLIS.

# PAVEMENTS OF INDIANAPOLIS.

*By J. B. Nelson, City Engineer, Indianapolis, Ind.*

The state of Indiana was admitted into the Union in 1816. In the year 1819 congress gave the state four sections of land as a site for the permanent capital of the state, to be selected from any of the unsold public lands. In the same year the State Legislature appointed a commission of ten men to make the selection, and on the 7th day of June, 1820, after a great deal of wrangling and difference of opinion, they chose the site of the present city and named it Indianapolis. The argument advanced at that time in favor of this name was that the Greek termination of the word would indicate to all the world the location of the city—the city of Indiana.

It was at that time far from any settlement, the nearest store being sixty miles away; but it was very near the geographical center of the state, and is today, eighty-three years later, very close to the center of population of the state, as well as the United States, the exact center of population of the United States in 1900 as established by the Government authorities, being but a few miles south of the city.

It was not until five years later, in 1825, that the capital was moved to Indianapolis from the old territorial capital of Corydon, a small village in the southern part of the state, some miles back from the Ohio river.

The original town—what we commonly call the original mile square—was laid out by Alexander Ralston, a surveyor who had been concerned in Burr's expedition, the failure of which had left him in the West. Ralston had, when young, assisted in the survey of Washington City, and the ideas obtained in that work were employed to some extent in the general plan of this city. The Circle, 3.12 acres in area, now occupied by the State Soldiers and Sailors' Monument, is the center of the square, around it being an 80-foot street. From the extreme corners of the four adjacent squares, avenues 80 feet in width, lead to the northeast, northwest, southeast and southwest. The first street south, Washington-st., running east and west, was made 120 feet in width. The remainder of the mile square was laid off into regular squares of 420 feet separated by 90-foot streets, following the cardinal points of the compass, each square having a 30-foot alley running east and west, and a 15-foot alley running north and south. Many of these alleys are now dignified by street names. Unfortunately outside the original mile square, this ideal plan has not been followed closely, most of the streets not being so wide. But the four diagonal avenues have been extended.

It may be of interest to note that Washington-st., at present the most important thoroughfare of the city, formed a part of the old National road, inaugurated in 1806, beginning at Cumberland, Md., and crossing West Virginia, Pennsylvania, Ohio, Indiana and Illinois to St. Louis, a distance of about 800 miles. That part of the road in the vicinity of Indianapolis was built in 1833 and 1834 under the supervision of Maj. Ogden. It included the construction of a two-span wooden bridge over White river, which was in service until last year when it was removed to make way for a new bridge. The appropriations by the National Government for building and maintaining this road continued to 1839, when the Government gave part of the road within its boundaries to the State of Indiana.

In 1847 the State Legislature granted a city charter to Indianapolis. The estimated population at that time was 6,000. Practically the only street at that time was Washington-st. and it was full of stumps. Bouldering for streets was introduced in 1850 when Washington-st., between Illinois and Meridian-sts., was so paved. Later considerable paving of this kind was done, but practically all this has been supplanted in recent years with more modern pavements.

The modern paving system of the city can be said to have originated in the year 1888, when Washington-st. from Alabama-st. to Mississippi-st. (now Senate-ave.), was paved with a tar macadam, known as vulcanite, there being about 20,000 square yards of it. This pavement was laid in three layers to a total depth of 8½ inches. It was "what is known as Filbert Vulcanite Ashpaltic Pavement, improved by Burdock's Patent No. 394,-126 and to be equal in every respect to that laid on K-st., between Ninth and Eighteenth-sts., N. W., Washington, D. C., in 1874 and 1875," and cost $2.60 per square yard. In 1889, about 13,500 square yards of the same kind of pavement was

laid in three streets, only about 900 square yards being still in use. The pavements in Washington-st. and Pennsylvania-st. were resurfaced with asphalt in 1898 and 1899 respectively, after having been down ten years, and the Illinois-st. pavement was resurfaced with asphalt in 1901, after a life of twelve years.

In the year 1889 an ordinance was passed for the first sheet asphalt street in this city, and five streets—about 37,640 square yards—were paved in 1890 with Trinidad asphalt, a 2½-inch wearing surface without binder being laid on a 6-inch hydraulic cement concrete foundation. All are still in service with one exception, which is being resurfaced at the present time. One street paved originally in 1892 has been resurfaced during the present year, Illinois-st., from Washington-st. to Ohio-st., was resurfaced in 1901, after being laid ten years. This is the shortest life of any asphalt pavement laid in this city. These pavements all had a five-year guaranty. Proper provision was not made for taking care of them after the guaranty expired, or they might have been made serviceable longer.

In 1896 the guaranty period for both asphalt and brick pavements was increased from five to nine years, and the specifications were modified to provide for a two-inch asphalt wearing surface on a one-inch binder, which is the present practice. All asphalt, brick and wooden block pavements are now laid on a six-inch Portland cement concrete foundation, all asphalt pavements having brick gutters. At the present time the city of Indianapolis has a total of 1,006,610 square yards of asphalt pavement—377,840 square yards under guaranty and 627,770 square yards on which the guaranty has expired.

Indiana-ave. from West-st. to Fall Creek was paved in 1897 with Kentucky rock asphalt. Three contracts amounting to 18,775 square yards have been completed during this year, of "Obispo" California asphalt. All others are Trinidad or Bermundez asphalt. Indianapolis has no block asphalt streets.

Altogether, since the present system of paving was adopted, eight resolutions have been passed for resurfacing vulcanite and asphalt streets, and the cost thereof has been assessed against the abutting property the same as original construction. In some cases the property owners have objected strenously to this, claiming that re-surfacing should be paid for by the city. In a suit, recently, one of the local Superior Courts decided against this contention of interested property owners and an appeal has been taken to the State Supreme Court.

The estimated average cost of standard asphalt pavements in Indianapolis at the present time, with a nine-year guaranty, is $2.10 per square yard, not including grading. This includes one-inch binder and two-inch wearing surface on a six-inch Portland cement concrete foundation.

For streets subjected to heavy traffic, brick has given very good satisfaction as a paving material, and while not so popular as asphalt or creosoted wooden block for residence streets, yet it has been used not a little for such purpose. Indianapolis has had a somewhat varied experience with brick pavements; some have been poor and others first class. Some of the first pavements being bad, had a tendency to bring brick into disrepute for a time, but recently brick streets have become more popular, by reason of care being exercised in the selection of the brick themselves, and the manner of laying them. Brick are used for paving alleys almost exclusively. The first brick pavements were put down in 1891, since which time 448,000 square yards have been laid, 103,100 square yards being under guaranty at the present time, and 344,900 square yards on which the guaranty has expired. The present practice is to lay the brick with a two-inch sand cushion on a six-inch Portland cement concrete foundation, and grout with one to one Portland cement filler. No expansion joints are provided. In the past some alley pavements have been made on a rolled gravel or broken stone foundation, but this is no longer done. Not including grading, the average estimated cost of brick pavements at the present time, with a nine-year guaranty, is $1.70 per square yard.

Wooden Block Streets—While not strictly speaking the first, yet in a sense Indianapolis may be said to be the first city in the United States to build creosoted wooden block pavements.

Including the contracts now under construction, Indianapolis has 350,205 square yards of wooden block pavements, of which 226,760 square yards have been creosoted. The first of these pavements was put down in 1895, in Alabama-st., from Ohio-st. to Ft. Wayne-ave., of round cedar blocks, untreated, on a rolled broken stone foundation. This pavement is rough to drive over, but the blocks are in a fair state of preservation, and it has been repaired but little. In the following year 44,500 square yards of rectangular Wash-

ington redwood block pavement was laid in Meridian-st. and Central-ave. These blocks were untreated. At the time they were laid, Mr. Brown, who was then city engineer, informed the property-owners that they could not be depended upon to wear longer than six years. Considerable repairing has been done, but they are good for two or three years longer, after having been down eight years. Later some blocks were laid which were merely dippped in the preservative. The first creosoted wooden block pavements were laid in 1898.

Not including grading, the average estimated cost of creosoted wooden block pavement in Indianapolis this year has been $2.80 per square yard, with a nine-year guaranty. This includes a six-inch Portland cement concrete foundation and the blocks are treated with twelve pounds of Kreodone oil.

Macadam Pavements.—Indianapolis has very little stone macadam pavement, the one important thoroughfare being Capitol-ave., from Indiana-ave. to Thirty-fourth-st., built in 1895 to 1898.. This was a very expensive pavement, the material being laid in four layers to a total thickness at the center of nineteen inches, the top layer of four inches being granite.

Approximately 50,000 square yards of flint rock macadam pavement has been laid on residence streets this year at an estimated average cost of $1.30 per square yard, not including grading. This has been built with thirty-inch brick gutters.

General Plan of Street Improvements—After the main business thoroughfares were improved, the general plan laid out provided for improving, first, the north and south streets within the "mile square," next the east and west streets within the "mile square," then the main north and south streets outside of the mile square and last the east and west streets, or cross streets, outside the mile square.

There has been some departure from this plan, but in a general way it has been followed. The first street improvements were made with rather wide roadways, but the tendency in recent years has been to decrease the width of the improved roadways. The roadway of a 60-foot residence street on which are no street railway tracks is now never made more than 30 feet between curbs, and a street 70 feet or more in width, not more than 36 feet between curbs. During the past two or three years fully three-fourths of the residence streets have been improved to a width of 24 feet between curbs, these improvements, you understand, being made away from the central portion of the city. This gives sufficient width of roadway for all practical purposes, gives greater width of lawns in front of the houses, and decreases materially the first cost of the improvement to the abutting property, and the cost of maintenance to the city.

During the past few years nearly all sidewalks have been built next to the curb where possible to so locate them without disturbing shade trees. This may be said to have developed into a fad in this city. Many comparatively good brick walks on the property line have been torn up and new cement walks built next to the curb, so that the property owners may obtain wider lawns between the walk and their houses. I am apprehensive that this may lead to encroachments on the street in the future. It has already resulted in some cases in reducing the practical width of the street, as houses have been built directly on the property line. This method of construction presents some engineering difficulties which I shall not attempt to discuss at this time.

While the modern system of street improvements was begun previous to that time, the greater part of it has been carried out since the adoption of the present City Charter, which was given to the city by the State Legislature in 1891. The method of making improvements under the provisions of the charter was outlined in the paper.

Paving Between Street Railway Tracks.—Under the terms of its franchise the local street railway company is required to pave between its tracks and eighteen inches on each side thereof, with the same material and in accordance with the same specifications under which the rest of the street is paved, unless permitted by the board of public works to use some other paving material. On brick or creosoted wood block streets this space is paved with the same material. On asphalt streets it is now the universal practice to permit the street railway company to pave between its tracks with brick.

Maintenance of Pavements.—The city of Indianapolis is just beginninig to realize the importance of making proper provision for maintaining its improved streets. This is the first year that an appropriation has been made for this purpose at all commensurate with the needs. As a result of this in the past the asphalt pavements especially have been more or less neglected and it has been necessary to resurface some streets when

RIVERSIDE PARK BOULEVARD, INDIANAPOLIS.

the original pavement had been down but ten years. A fund of $50,000 has been available for the year 1903 for repairing the so-called permanently improved streets. This fund has been practically exhausted at the present time, $39,477.75 having been expended on the asphalt pavements. I estimate that about $3,000 additional will yet be used for this purpose before the end of the year.

The number of square yards maintained is 589,680, embracing all the pavements on which the guaranty had expired at the first of the year, except three streets which it was considered advisable to resurface. Including the estimated expenditure yet to be made, the average cost per square yard this year will be $0.072. During the year 1902, for the same pavements, the average cost of repairing was only $0.0232. This latter sum, however, was insufficient, and the repairs could be made only in a very incomplete manner. More money could have been used to advantage had it been available. None of these pavements have been laid longer than thirteen years, and none less than eight years, the average being about ten years. All were built with a five-year guaranty. The guaranty period was changed in 1896 from five years to nine years, so that no guaranties have expired since the year 1900, and no more will expire until 1905.

Using as a basis the average character of the asphalt pavements built in this city it is my opinion that for maintaining the same after the expiration of the nine-years guaranty period the most economical plan in the end should provide for an average repair fund of about 10 cents per square yard per annum. By so doing, and by making the repairs judiciously and at the proper time, it will be practicable to maintain them for a further average period if six or seven years. This is approximately 5 per cent. of the original cost per annum. In Indianapolis at the present time, this would mean an available yearly repair fund of $58,968.

The patching has been done by contract with one of the asphalt paving companies at so much per square yard of actual measurement of patches. The price this year has been $0.95 for "skim patches," $1.30 for re-surfacing on old concrete and $1.90 for new concrete and pavement. Very little new concreting has been done and practically no skim patching. During a part of this season, the "Economic Asphalt Surface Heater," controlled by Mr. F. O. Blake of Cincinnati, has been used. With this machine 10,836 square yards of repairing was done at an average cost of $0.805 per square yard actually repaired, Mr. Blake being paid for the use of the machine twenty-five per cent of the cost of all labor and materials, the city furnishing a steam roller and all necessary tools. Nothing is included in the above cost for the use of the roller and tools. This machine, although received with some misgivings at first, gave very good satisfaction. It was not used on the worst pavements which have not been too long neglected.

Our brick and wooden block pavements not under guaranty have been repaired by day labor. The guaranty period has expired on only the first wooden block pavements put down which were laid in 1894 and 1895 and which were not creosoted or treated in any manner. The patching has been done with creosoted blocks.

Area of City, etc.—The city of Indianapolis has a total area of 29.135 square miles. From its northern boundary to its southern boundary it measures 6.50 miles; from east to west it measures 8.67 miles. The city has a total length of streets of 445 miles. At the beginning of the present year 95.42 miles of streets and alleys were improved as follows: Paved with asphalt, 46.10 miles; paved with brick, 27.35 miles; paved with wood block, 17.31 miles; paved with macadam, 4.66 miles. Many miles of streets have been graveled, an exact statement of which is not at hand.

# MEDINA SANDSTONE PAVEMENTS IN BROOKLYN, N. Y.

*By C. D. Pollock, Ass't Engr. of Highways.*

Last year Brooklyn laid two Medina sandstone pavements on a concrete foundation under practically the same specifications as our standard granite block pavement, except for the dimensions of the blocks, closeness of joints and the size of gravel. Tar and gravel joints were formerly used. This necessitates fairly open joints between courses with a half-inch maximum. These pavements are wearing flat on the surface after one year's use, but the joints become rather too prominent. This year all our Medina block pavements have been laid with joints of Portland cement and sand in the proportion of 1 to 1, mixed to a fairly liquid grout. Although this method has had only a few months' test in Brooklyn, the indications are that this will give us a much better result than where we used more open joints and tar and gravel as a filler.

This season we have used Medina curb and bridging with the Medina block pavement. Our curb is set in Portland cement concrete, a bed of six inches underneath the curbstone and six inches in front and same behind it.

The foundation for the pavement is six inches of concrete mixed in the proportion of one Portland cement, three parts clean sharp sand and six parts stone. On this foundation there is spread a bed of clean, coarse sand to a depth of one and a half inches, and then the blocks are laid according to the following specifications for sandstone pavements, the tar and gravel joints applying to the 1902 contracts and the cement joints to those of 1903:

Bridgestones—New bridgestones shall be of the same quality of stone as the blocks, free from all imperfections. The top shall be dressed to a surface not varying in evenness more than ¼ of an inch. The sides and ends shall be dressed square down and the latter cut to a transverse bevel of 6 inches in the width or to such other bevel as may be directed, and the jointing from the top to bottom shall give joints not greater than ¼ of an inch.

Paving blocks shall consist of the best quality of Medina sandstone, free from quarry checks or cracks, and shall be quarried from fine grain, live rock, showing a straight and even fracture. The material shall be of uniform quality and texture, free from seams or lines of clay or other substances which, in the opinion of the chief engineer, would be injurious to its use as paving material. Blocks shall measure not less than 3½ nor more than 5½ inches thick, and not less than 6 nor more than 6½ inches deep and from 7 to 12 inches in length. Stones to have parallel sides and ends and right angle joints. All roughness in joints or stones to be broken off so that when set in place they shall have tight joints for a distance of at least 3½ inches from the top down, the top to have a smooth, even surface, with no projection or depression exceeding ¼ of an inch.

Upon the bed of sand the stone blocks and crosswalks must be laid. The stone blocks are to be laid in straight courses, at right angles with the line of the street, except in intersection of streets (including the space within the railroad tracks) when the courses shall be laid diagonally, except in special cases when they shall be laid at such angles, with such crown, and at such grades as the chief engineer may direct. Each course of blocks shall be of uniform width and depth, and shall be gauged and selected for the pavers on the sidewalks, and so laid that all longitudinal joints or end joints shall be close joints and shall be broken by a lap of at least three inches, and that joints between courses shall be not more than one-half inch in width top and bottom. As the blocks are laid they shall be covered immediately with clean, hard, hot, dry gravel, artificially dried, and shall be brushed into the joints to a depth of three inches. The blocks shall then be thoroughly rammed by courses at least three times by a rammer weighing not less than eighty pounds—no iron of any kind being allowed on its lower face to come in contact with the paving, and until brought to an unyielding bearing, with a uniform surface, true to the roadway or the established grade.

The joints shall then be filled with clean, dry, hot gravel, of proper size as herein specified, heated in pans especially provided for that purpose and poured from cans having small spouts, and thoroughly settled in place with wire picks, until the level of the gravel is at least two inches below the top of the pavement. The gravel used between the blocks shall be of such size as will pass through a sieve having four meshes per square inch, and must be screened dry. There shall then be immediately poured into the joints, while the gravel is still hot, boiling paving cement, as hereinbefore described, heated to a temperature of 300 degrees, until the joints and all interstices of gravel filling are full and will take no more and are filled flush with the top of the blocks. Dry, hot gravel must then be poured along the joints, filled with paving cement, as above described.

When Portland cement is used in the joints the blocks shall be laid as closely as possible, and after having been rammed till they are brought to a firm bearing and an even surface, a grout made of equal parts of Portland cement and clean, sharp sand shall be poured upon the surface of the pavement and swept into the joints, and this process repeated until all the joints are completely filled and remain full.

The cement joints bind the blocks together very thoroughly. Wherever we have had occasion to take out any blocks after the joints have become well set, the blocks have broken as readily as the joints; in fact, we have obtained practically a solid pavement. It is smooth and yet not slippery.

The requirements for the cement used in the joints are as follows: The cement used must develop or exceed the following tensile strength per square inch: Neat—four hours in moist air, twenty hours in water, 225 pounds. Neat—one day in air, six days in water, 500 pounds. One part cement, two parts standard sand by weight, one day in air, six days in water, 225 pounds.

In grouting the joints we have found that one barrel of cement will do from 12 to 13 square yards of pavement, depending upon the run of the blocks and also upon the sand underneath. When the sand bed is composed of a coarse, rather than even-grained sand, more of the grout runs under the blocks than if the grains of sand were well graded. On a street where our granite pavers average about 55 sq. yards per man per day, the same men pave about 45 sq. yards of Medina blocks. Because of the greater latitude allowed in the width of Medina blocks, the paver is obliged to be more careful in selecting stone to keep his courses even and close.

The prices bid for Medina sandstone pavement with Portland cement joints are practically the same as for granite with tar and gravel joints. The average price of the two contracts of 1902 was $2.41 per sq. yd. for the pavement, including the joints, and the average of the five contracts this year is $2.87. The average price bid on four granite contracts at about the same time as these last is $2.80. These prices are all exclusive of the foundation.

The total amount of Medina block pavement either completed or under contract in Brooklyn is a little over 44 000 sq. yds., of which over one-half is completed at the present time.

In the Medina sandstone pavement we have a surface between that of sheet asphalt and that of granite blocks, hence it seems to the writer that its field in Brooklyn will be mainly on residence or semi-residence streets, where the grade is too great for sheet asphalt and yet it is desirable to have a smoother and less noisy pavement than granite.

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## PAVEMENTS OF NEWARK, N. J.

*By E. Adam, Engineer of Streets.*

The first pavement in the city was laid in 1853, and consisted of cobble-stones; this event was almost brought about by coercion. In the previous year Kossuth visited Newark, on which occasion a few citizens of the progressive element hired several men to stand in a scow, which was drawn by a tandem of horses through the mud in the principal street, now the pride of the city, it being 132 feet wide.

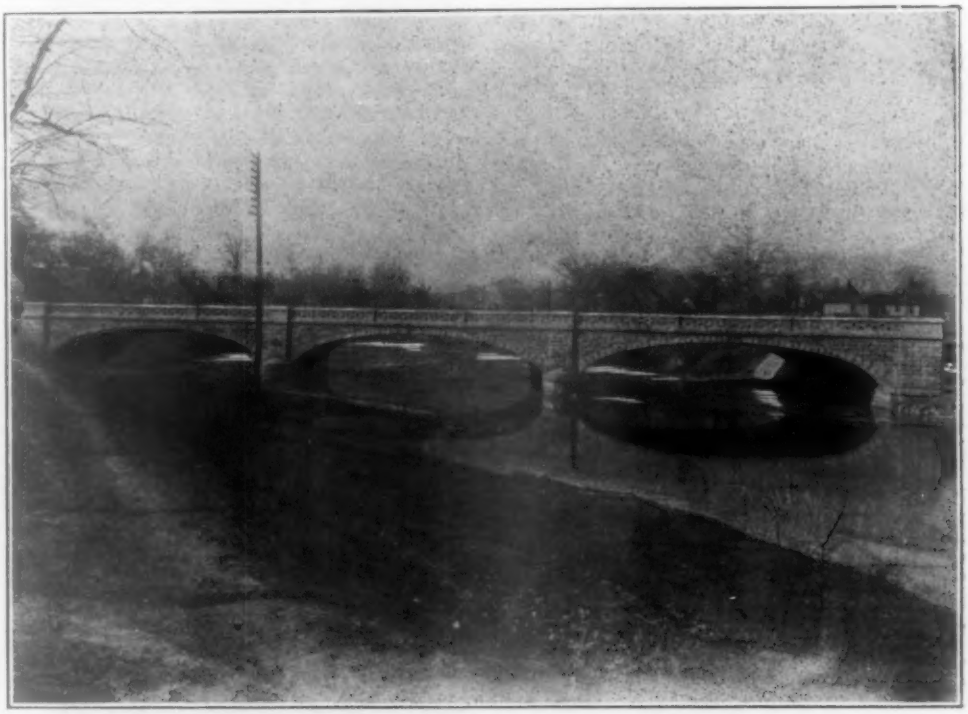
The use of cobble-stones was almost exclusively continued until the year 1872, when other pavements, consisting of granite and trap-rock blocks laid on a sand foundation, and telford were introduced. The maximum price paid for granite pavement in that year was $1.95 per square yard; for telford, 16 inches deep, $2.75.

In the year 1869 the American Nicholson Paving Company laid 8,217 square yards of wood block pavement in a section of our main thoroughfare at $4.50 per square yard, it being replaced in 1879 with oblong granite blocks on sand; but the wood pavement, long before it was removed, was in a poor condition.

About the year 1888 two short streets, containing 3,700 sq. yds., were paved with asphalt blocks on a sand foundation; the blocks then used were 12 in. long, 4 in. wide and 5 in. deep. The price paid for the pavement in one of the streets was $2.54 per sq. yd. One of the streets was repaved with granite block in 1893, and the other with sheet asphalt in 1894, but both old pavements were in a poor condition along the center of the roadway before the others were substituted. There was none laid since until last year, when blocks only two inches deep were used

in paving the tracks, in a street which was paved with sheet asphalt outside of the tracks. There are a number of them cracked, but principally caused by the steam roller which was used in laying the sheet asphalt. The blocks were bedded in Portland cement mortar, which was laid over the concrete foundation.

It was not until 1892 that the first granite block pavement was laid on concrete with gravel and paving mastic in the joints, or what is commonly called improved granite block pavement; the sum paid was $3.29 per sq. yd.



ILLINOIS STREET MELAN ARCH, INDIANAPOLIS.

The first sheet asphalt pavement was laid in 1889, the specifications calling for Trinidad lake asphalt, two streets being paved with this material in that year, one at $2.93 and the other at $2.80 per sq. yd., under a guarantee of five years. The one is still in a fair condition, while the other has required numerous and quite extensive repairs. The greater part of the asphalt pavements laid consist of Trinidad lake asphalt; some of Trinidad land asphalt, which is in as fair condition as the other. A few streets were paved with the use of Bermudez lake asphalt and a limited number with asphalt obtained in Santa Barbara, Cal. In one street which was surfaced with Trinidad land asphalt the temperature of the weather was so low that the concrete was frosted to a depth of four inches, and twice the snow had to be shoveled off the binder before the wearing surface could be laid, and yet the pavement is in a good condition after five years of service.

At first the wearing surface was laid on a cushion coat ½ inch thick, until 1893, when a binder course 1½ inches thick was substituted for it. Of course this city, like a good many others, experienced the shoving or rolling effect upon a mere cushion coat, although some on a binder course have that tendency also, but in a less degree. One street containing 3,500 sq. yds. has been entirely resurfaced on account of the bad rolls, seven years after the original surface was laid. As the guarantee for five years had expired, the city had to pay for the resurfacing, which cost at the rate of $1.53 per sq. yd., including the binder course.

It was presumed by some persons that the expansion of the concrete had a tendency of causing cracks in the asphalt

covering. I therefore made a provision in our specifications permitting the contractor to provide for expansion joints in the concrete at intervals of 300 feet, which were to be filled with a flexible paving mixture; but none of the contractors so far have availed themselves of this privilege.

There was only a five-year guarantee required for the maintenance of the asphalt pavements until the year 1898; from then on it was made ten years. In order to avoid the possibility on the part of property-owners along the line of the pavement to contend in court that they were burdened with an undue repair account, the contract provided for the payment of the sum of 25 cents in addition to the price bid per sq. yd. for the maintenance of the pavement during the second period of five years; to be paid in five yearly installments, providing the pavement was in good condition. This remained in force until the year 1900, when the additional allowance was reduced to 12½ cents, owing to statements found in reports of other cities, which showed that the pavement could be maintained for that amount and period when properly laid.

For the past three years the board employed a chemist to make analyses of the materials contained in the asphalt mixture; although small shortcomings were not prosecuted, yet this precaution has given satisfactory results.

I was informed that in the city of New York only a five-year guarantee is now required, instead of ten or fifteen years, as formerly. I can only attribute this change to the facility which that city has, through their salaried and experienced chemist, in determining the proper requisites of an asphalt mixture in order to procure a good pavement. Other cities which have not this facility, and they are numerous, will, in my opinion, still look for security in an extended period of guarantee.

Although the first cost per square yard for asphalt pavement laid in this city in 1902, was quite low in comparison with that paid in other cities, averaging but $1.89 in streets without car tracks, yet the board has practically closed down on asphalt paving this year, in anticipation of the large amount of money which will have to be paid the companies for maintenance under the contracts for a ten-year guarantee.

It has been the custom of the board within the past three years to include more than one kind of pavement in the legal proceedings, and when the proposals for the work were received, to decide which pavement to select. There is no doubt that this method, in most cases, had a tendency to procure moderate prices.

The first brick pavements were laid in 1895, and moderately continued until within the past two years, when the quantity laid increased more rapidly. There are pavements laid with fire-clay and shale brick and block from different manufacturers, and laid with paving mastic, cement grout and sand filler in the joints. Cement grout filler was used in the first pavements laid, without providing for expansion joints, and the result was the unavoidable rumbling noise. For the last street paved in which a cement grout was used, measuring 60 feet between curbs, with a double track in the centre, the specifications required five transverse joints, ⅜ in. wide, at intervals of 25 feet, and ½ in. wide along the curb, to be filled with paving mastic. There was no complaint made of any objectionable noise, but of the tar which was forced out of the joints and accumulated in the gutters. Lately only sand was used as a filler; this prevents any possible noise, but exposes the edges of the brick to greater wear.

I might almost say that the city presents a fair opportunity of object teaching in brick paving, on account of the variety of methods and materials applied therein.

The board has recently awarded three contracts to Warren Bros. for laying their bitulithic pavement, amounting to 31,000 sq. yds., with an additional 8,000 sq. yds., which is to be laid in the space occupied by a double track street railway and one foot outside, in one of the streets under contract. The pavement is to be 8 in. thick, consisting of 6 in. foundation and 2 in. bituminous mixture or wearing surface, when roughly rolled. The price is $2.25 per sq. yd. in each instance and under a guarantee of ten years, the surety bond to be for twenty-five per cent of the amount of the contract. In addition to this bond, five per cent is to be held of the [illegible] estimate for five years, 2 per cent to be refunded at the end of the third year and 3 per cent at the end of the fifth year, providing the pavement is in good condition at the respective periods. The contract forms for all other pavements contain the same conditions. There is no extra allowance in addition to the price bid per sq. yd., as is the case for asphalt pavements. The guarantee clause in the

contract also provides that the proposal for laying the pavement shall be accompanied with an affidavit, duly verified, "that the amount bid has not been in any degree increased by reason of the guarantee required, and that it does not include any estimate whatever of the cost of repairing said pavement, if the same shall become necessary during the guarantee period."

In preparing the specifications I inserted the clause relating to the requirements of the bitumen found in a copy of New York specifications, as I considered it preferable to the one contained in another copy, having no doubt of its being compiled by the experienced chemist in the employ of the city of New York. It reads as follows:

All grades of the bituminous cement shall be free from water, petroleum oil, water, gas or process tars, natural asphalt, soluble salts, and shall be especially refined at low temperatures, preventing undue oxidation or injurious molecular disruption; and the process shall, as much as possible, remove all the light oils, napthaline and other crystalline matter, which are easily susceptible to atmospheric influences. The bituminous cement shall be unaffected by water; it shall contain a sufficient quantity of free carbon filler to give the best results, and after determining a standard of purity, shall contain a uniform quantity of carbon throughout the entire work

I have also inserted the following: "The engineer or his deputies shall at all times have free access to the plant and materials belonging to the contractor and have the right to take a sample of the various materials for the purpose of making examinations, tests and chemical analysis. The depth of the pavement will be constantly tested by gauges furnished by the engineer; but after its completion and before the payment of the final estimate the general superintendent of works may direct to have the same tested as to depth or for other purposes at various points alon the entire length of the pavement; the contractor is to make the required cuttings and thereafter restore the pavement to its original condition withou any compensation;" being the same clauses as contained in the specifications for asphalt pavement.

This kind of pavement being patented, it was necessary that a petition in writing be presented to the board, signed by the owners of a majority of the feet of land fronting on the respective streets in accordance with a provision of the municipal laws.

It was in the year 1889 that one of the local papers had published an article relating to tar macadam pavements in the city of Hamilton, Ont., particularly laying stress upon the moderate cost. In going to the convention of the society held in Toronto in the same year, the members of the board at that time, stopped over on their way to Toronto and made a personal examination of those pavements. They were quite enthusiastic about them, and thought they had found a good and cheap pavement, forming the mean between Telford and stone block pavements, both as to cost and conditions, avoiding the heavy repair account and dust nuisance of the first and the larger price and roughness of surface of the other. The cost in Hamilton at the time was 80 to 85 cents per square yard, consisting of a ten-inch pavement, six inches of two to three inch stone for foundation and four inches of one and one-half inch stone and screenings mixed with coal-tar, for the top covering or wearing surface. We were shown a residential street in which the pavement was said to have been laid eleven years previous, the surface being still hard but uneven.

In the succeeding year, or in 1900, the board authorized me to go to Toronto to observe the laying of tar macadam in one of the streets. That pavement was only 8 in. deep, 4 in. foundation and 4 in. of tar mixture; the cost was about $1.35 per sq. yd. I wanted to make myself familiar with the manuer of laying such pavement, as the board intended to lay it in Newark on an avenue containing about 24,000 sq. yds. as a top covering over a telford pavement which was in need of extensive repairs. It was the intention of resurfacing only two blocks at first. I had made all the necessary preparations when the idea was abandoned. I had estimated the cost to be 75 cents per sq. yd, for a depth of 4 in. tar macadam covering when rolled. The person who was to furnish the tar and kettles laid a small area of tar macadam in the driveway to his factory yard, and it is in perfect condition this day. He informed me that it was only four inches thick and that he used only 1½ in. stone.

I concede that the methods adopted by the Warren Bros. in preparing the mixture for the top covering, aside from the superior quality of their bitumen, is scientific and better than the one that had been pursued in laying the ordinary macadam.

One of the principal, if not the principal question is, how long will the cohesive qualities of the bitumen last. It is my view that when the end of that period has arrived, the top covering will to a certain degree disintegrate, in a similar manner

as an asphalt wearing surface, on account of containing mineral particles graded down from a size of 1½ in. to mere sand.

It was my opinion that the price of bitulithic pavement was rather high, in comparison with that paid in our vicinity for a telford or macadam pavement. In 1901 the city contracted for laying 40,000 sq. yds. of telford pavement at 97 cents per sq. yd., under a guarantee of maintenance for five years. The pavement is of trap-rock throughout and ten inches deep; having a regularly laid foundation of 6-inch stone; an intermediate course of 2-inch stone, two inches deep, and a top layer of 1½-inch stone, also two inches deep; with a thin cover of screenings.

At the same time of letting the contracts for bitulithic pavement, there was a contract awarded to the U. S. Wood Preserving Co. of New York for paving a street with its creo-resinate wood blocks; the price is $3.76 per sq. yd. and quantity 1,300 sq. yds. In the city of Brooklyn, the price was $3.19 for the same kind of pavement and laid in the same manner, with the exception that our specifications required a mastic filler in the joints for a width of four feet on each side of the curb, instead of all sand, as in Brooklyn.

I have also adopted the method pursued in that city of laying and bedding the blocks in Portland cement mortar on top of the concrete, instead of on a sand cushion; for the reason that if any moisture should work its way under the blocks it would have a chance to do more mischief. I experienced this with a granite block pavement, where I was not permitted by a former Board to use an impervious filler in the joints. Of course, there was no chance of deteriorating this material by moisture, but of lifting the blocks by action of the frost and making the surface somewhat uneven. There were a few other elements connected with the contract awarded for the wood block pavement, but, in my opinion, of not such material consequence as to warrant the difference between the two prices. The matter was submitted to the property owners, who decided to have the Board award the contract at the price bid. The guarantee for maintenance and amount of bond are the same as for bitulithic pavement.

Total number of miles and square yards

AVERAGE COST PER SQUARE YARD.

| Year | Asphalt | Brick | | | | Granite | |
|---|---|---|---|---|---|---|---|
| | | 6 in. Con. Base & 1½ in. Sand Cushion | | | | | |
| | | Cement Grout Filler | | Sand Filler | | | |
| | 6 in. Con. Base, 1½ in. Binder & 2 in. Wearing Surface | Shale | Fire-clay | Shale | Fire-clay | 6 in. Con. Base, 2 in. Sand Cush. Gravel and Tar Filler | 4 in. Sand Foundation only. |
| 1901 | 1.85½ | | 2.29 | | | 2.68 | 1.78 |
| 1902 | 1.90⅝ | | 2.04 | | 1.94⅞ | 2.78 | 1.96⅞ |
| 1903 | 1.97 | 2.12 | | 1.92½ | 2.16 | 3.15 | 2.23½ |
| MAXIMUM COST PER SQUARE YARD. | | | | | | | |
| 1901 | 2.11 | | 2.33 | | | 2.73 | 1.98 |
| 1902 | 2.09 | | 2.04 | 2.10 | 2.05 | 2.79 | 1.98 |
| 1903 | 1.97 | 2.15 | | 2.09 | 2.33 | 3.15 | 2.45 |
| MINIMUM COST PER SQUARE YARD. | | | | | | | |
| 1901 | 1.75 | | 2.25 | | | 1.98 | 1.68 |
| 1902 | 1.89 | | 2.04 | 2.10 | 1.85 | 2.74 | 1.88 |
| 1903 | 1.97 | 2.09 | | 1.83 | 2.03 | 3.15 | 2.18 |

of street pavement in the city of Newark (including the work contracted for but finished, and excepting pavement in the street railway tracks):

| | Miles. | Sq. Yds. |
|---|---|---|
| Asphalt | 51.10 | 1,035,498 |
| Granite block | 47.34 | 923,597 |
| Brick | 10.58 | 220,730 |
| Trap-rock block | 12.29 | 210,090 |
| Cobble or boulder | 10.44 | 176,292 |
| Bitulithic | 1.48 | 30,780 |
| Wood block | 0.08 | 1,300 |
| Total | 146.42 | 2,775,189 |

The cost of all pavements up to date (including those unfinished) is $7,052,110; excepting pavements done under private contracts, amount paid to inspectors, legal expenses and other charges.

The average amount paid to inspectors during a previous period of five years was 1 8-10 per cent. of the cost of the pavement, or 3 2-3 cents per sq. yd.

The average price per square yard paid and to be paid within the last three years, including the present one, is as shown in the table on the opposite page.

The concrete in all cases consists of a matrix containing one part of common cement, two parts of sand and five parts of stone; and the necessary excavation is included in the cost of the pavement. The average amount assessed upon the property owners abutting the improvement, was 78 per cent of the total cost, during a period of four years.

In 1895 an act was passed by the Legislature, giving the opportunity of paying a paving assessment in five yearly installments, with a charge of 5 per cent. interest. A statement presented in 1899 by the City Auditor shows that in the first year after the act was confirmed, 46 per cent. of the cost assessed on the property owners was paid; 22 per cent. in the second; 11 per cent. in the third; 10 per cent. in the fourth, and 11 per cent. remained unpaid, the fifth year not being covered.

Not many persons, excepting the officials connected with the respective departments, realize how much money is invested in street improvements, until they see the aggregate cost. It is deplorable that pavements suffer so much by constant disturbances of one kind or another. No matter how carefully the repairs are made, the original condition can never be restored.

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## THE CONSTRUCTION OF WARREN'S BITULITHIC PAVEMENT.

*By C. A. Kenyon, Indianapolis, Ind.*

When this pavement was first invented it was called Warren's Bituminous Macadam Pavement. The name was deceptive. It led many well meaning people to believe that it was made by mixing bitumen with macadam stone, and laying it as a macadam is laid. The name, together with these plausible but malicious statements had a tendency to deceive those who did not look carefully into the pavement and its construction. A name was therefore selected that was entirely new, one that could not be used to deceive people by the enemies of the pavement, and it was called Warren's Bitulithic Pavement.

It is true that it is made of broken stone and bitumen, but for all that, it is no more like the ordinary macadam roadway that the best Haviland China is like an ordinary building tile because they are both made out of clay.

It did not take engineers, public officials and property owners long to see the advance which had been made in pavement construction, as is evidenced by the following statement of the amount of Bitulithic pavement laid in the United States in the short time since its discovery.

| | |
|---|---|
| Laid in 1901, in 6 cities | 14,400 sq. yds. |
| Laid in 1902, in 23 cities | 440,831 sq. yds. |
| Contracted for in 1903 to July 15th | 858,999 sq. yds. |
| In less than 3 years | 1,314,230 sq. yds. |

You will agree with me, an unprecedented record.

In discussing methods of construction, I will commence with the foundation.

The sub-foundation should be prepared the same as for any other pavement; soft and spongy places in the grade should be removed and filled with proper material, and the grade should be thoroughly rolled, unless the foundation is so sandy that it will not pack, in which event rolling is an injury rather than a benefit. I believe that the best method of treating such a foundation is to bring it to grade (full) and flush it with water, and over this spread a thin layer of marsh or rather tough hay or straw, one inch thick, evenly distributed. Upon this spread the crushed macadam stone, broken so that the sizes are from one

inch to three inches in diameter, the dust and screenings being removed. If it will not increase the cost too much, place the coarsest stone at the bottom and roll and then top dress and bring to true grade with the one-inch stone.

Over this sprinkle lightly the number one composition, which is very fluid, and is for the purpose of aiding the strong, stiff number twenty-four composition to adhere to the cold stone, and as it is reheated by the application and rolling of the wearing surface, to penetrate between the stones of the base and bind them together and make the foundation waterproof.

The number twenty-four composition should be heated to a temperature of from 200 to 260 degrees F., and care should be taken not to burn it, and equal care should be taken to have it equally distributed over the surface. Pools or excessive amounts are not desirable, although I have as yet discovered no ill

C. A. KENYON, Indianapolis.

effects from this cause in the few instances I have noted.

Some advocate rolling this foundation, while others hold to the contrary view. If the foundation has been thoroughly rolled, I see little use or harm in it. The contractor sometimes wants to roll it as less of the surface mixture will be required, especially if the foundation is rough and the stone coarse.

Some engineers have felt that the pavement would be better with a hydraulic concrete foundation, but I believe that in nearly every instance such opinions were arrived at by academic reasoning, and have not the facts of experience back of them. I believe that with a reasonably solid sub-foundation, properly prepared, the bituminous foundation will be found to be superior to the concrete foundation for the following reasons:

(a) The broken stone is wedged together by the great pressure of the heavy rollers, and the under surface fitted under pressure into all of the inequalities of the sub-grade if it will carry a fifteen ton road roller. Such a foundation will carry any load that will be hauled over it. The hydraulic cement foundations are merely dumped onto the grade and lightly tamped, and such a foundation has not an even bearing, and is not fitted to the inequalities of the sub-grade. Few such foundations would withstand a fifteen ton road roller passing over them without damage.

(b) The bituminous is more elastic than the concrete foundation, and hence is better for the wearing surface as being homogeneous with it, and firmly uniting with it.

(c) If the sub-foundation under a hydraulic concrete pavement base is wet, the concrete draws itself full of water, by capillary attraction. In winter the water in the concrete freezes and expands and contracts to the injury of the foundation and wearing surface over it. Especially is this true when the wearing surface is asphalt or wood blocks. This has been demonstrated beyond question. Such a thing cannot happen with the bituminous foundation, for the reason first, that the spaces between the stones of the foundation are too large to permit of capillary attraction, and second, the the bituminous coating is entirely impervious to, and not affected by, water. If the water had such a head as to rise between the stones (which would be a very unusual thing) and freeze, I do not believe it could do any harm. It could not break any part of the pavement by expansion or contraction because of elasticity of the foundation, as well as the top.

(d) Bituminous foundations have proven their value by experience, for many have been in use in Washington, D. C., and other cities of this country, for over thirty years, and are giving perfect service at this time. I have examined many of them myself, and have talked with engineers and constructors who are familiar with them, as well as having consulted engineering books, and I have not known or heard, or read of any well authenticated, specific instance where a well-laid bituminous foundation for a street pavement has been other than successful.

We now come to the selection of materials, the preparation and laying of the wearing surface of the Bitulithic Pavement. To get the perfect wearing surface, the genius of the inventor, the art and thoroughness of the constructor, the intelligent watchfulness of the engineer are all taxed to their utmost.

Let me halt a little in this descriptive discussion, and recall to your minds the almost conflicting combination of qualities, that the best authorities tell us should be united in the perfect pavement surface.

Mr. Tillson names them, and gives each quality its percentage value as follows: Cheapness, 14 per cent.; durability, 21 per

cent.; ease of cleaning, 15 per cent.; light resistance to traffic, 15 per cent.; non-slipperiness, 7 per cent.; ease of maintenance, 10 per cent.; favorableness to travel, 5 per cent.; sanitariness, 13 per cent.; total, 100 per cent. The nearest that any pavement he names comes to these conditions is asphalt, 76 per cent.; brick, 67 per cent. A recent writer in Municipal Engineering on the same basis gives the Bitulithic Pavement, 82 per cent.

Mr. Baker, in his work on "Roads and Pavements," gives a table with some slight differences in the percentages of values of these qualities, and his judgment gives asphalt, 77 per cent.; brick, 70 per cent , and the writer in Municipal Engineering referred to, gives the Bitulithic Pavement on the same basis, 88 per cent.

Many who have studied the construction and watched the results of the Bitulithic Pavement, believe that its inventor discovered a construction that comes nearer meeting all these requirements, than any other form or method of construction in practice at this time.

The theory of the inventor, in short, was as follows: First, to get a material for the wearing surface that was universally available and durable, at moderate cost. Hard stone was selected (the harder the better). Stone had long been in use in block form, and as macadam. You know the objections to the material in both forms.

The theory worked out was to crush the stone into a variety of sizes, ranging from pieces one and one-half inches in diameter, to an impalpable powder; to predetermine the requisite quantity by weight of each size, that when all are properly mixed together, the smaller stones are properly distributed in and occupying the voids between the larger stones, and the still smaller stones performing a like function in the voids which they should occupy and so on down to the finest dust, thus making a mixture of the various pieces that in density was within 10 per cent. of the solid stone before it was broken into pieces; then covering completely each particle of such stone mixture, large and small, with a heated elastic waterproof bituminous cement, sufficient to fill the remaining voids and make the densest mixture practicable. Such a mixture, it was thought, could be laid in a sheet on the street, and produce a dense, smooth, durable surface, with a good foothold for horses, and one that could be easily and cheaply repaired and cleaned.

Such a result was worked out in the laboratory with results beyond expectations, but when an effort was made to duplicate the result on a large and commercial scale, obstacles appeared and multiplied, and it was only by the most indomitable energy and perseverance, united with creative ability of a high order, that the theoretical was made practical. A false step anywhere along the line threatened ruin. One of the first, and almost the most important thing, was to secure a commercial supply of a suitable bituminous cement. Asphalt, coal tar and roofing pitches were on the market, the owner of each of which thought his material was the best for making the pavement. Many thought any of them would do, but experience soon showed that there were no suitable cements on the market, that the known asphalt cements were not suitable, hence a cement had to be especially manufactured to obtain the proper results and new machinery, methods and appliances had to be devised or invented.

Another difficulty arose in getting the stone crushed in the proper sizes, and disposing of the rejected sizes. The crusher would not turn out the correct proportion of each size. Few, if any, of the crushing plants had the proper screen arrangement. This increased the cost above expectation. The crusher screened the stone cold, and it was often damp or wet, the fine would adhere to the coarse pieces, and another trouble arose, the proportions would go wrong. Finally it became necessary to devise and invent a screen and storage bin arrangement by which the stone could be separated into sizes after being heated, and stone of the same size placed in one bin and those of different sizes in other bins, in such a way that the exact amount of each size of stone could be weighed separately, and all placed in the revolving twin-pug mixer at the same time, while heated, after which the heated bituminous cement had to be weighed on a separate scale and poured into a mixer. After which it was dropped into a wagon and hauled to the street.

Difficulties in loading and unloading the wagons, in placing the same on the street, were almost as numerous. And after the machinery was invented, men had to be trained to operate it, and with each succeeding plant, a new force had to be trained. Analogous difficulties arose over the application of the flush coat, the spreading of the screenings, etc., etc. New problems all along the line. One would think that the asphalt industry would have furnished plenty of experienced men, but it was soon found that

the work was so different that workmen from that industry had to unlearn much before they could become efficient in this new work.

The Cement.—The greatest difficulty was in securing a suitable cement, uniform in density and quality. It is now generally recognized as firmly established that the merchantable Trinidad asphaltic cements contain salts soluble in water, and therefore this material was not believed to be lasting or suitable. There were and are scattered over the country in many cities, small areas of street pavements and sidewalks laid many years ago, the cementing material of which was manufactured from coal tar. It was and is true that, while these small areas have outlasted any mastic pavements made from other bitumens, alongside of them other parts of the pavements or walks supposed to have been made from the same material disintegrated and went to pieces in a short time.

An exhaustive study of coal tar revealed the fact that these old paving cements made from coal tar, lacked—

1. Uniformity in the quality of the tar from which the cement was made. Tars from different coals were often placed in the same still.
2. Uniformity in density or viscosity. There was no method in use by which tars of different quality could be brought to a uniform degree of quality and density.
3. Approximate uniformity of chemical and physical properties.

When the proper chemical combination (approximately) was discovered, there existed no machinery to manufacture it on a commecial scale, and suitable methods and machinery had to be devised to manufacture and test the product. These difficulties have been overcome and an excellent cement uniform in quality, chemical and physical, and of a standard, uniform density, is being produced for the purpose of making this pavement. This constitutes a distinct, radical and valuable advance in the paving industry. The cement is not affected by water and therefore renders the pavement perfectly waterproof.

When the wearing surface of a street pavement is made of the materials and in the manner I have described, it has great density, and approaches very nearly to a solid. Graded stone has from 9 to 11 per cent. of voids. Graded sand has from 27 to 35 per cent. of voids. In the stone mixture, the inherent stability of the stone permits the use of a softer cement, one with more life—one less affected by cold—more elastic. The cement fills all the voids and is not subject to attack by air and water in minute particles, as it would be if a sand mixture instead of a stone mixture were used.

The stone mixture graded as described has about one-tenth the surface area of particles that graded sand of the same volume has. If the same amount of bituminous cement is mixed with an equal volume of graded stone as is mixed with the graded sand, the coating of the cement on the stone particles must approximate ten times the thickness it would on the graded sand, and therefore, if exposed should endure ten times as long. This advantage will be apparent to the a priori observer.

The stone offers a rougher surface to horses and is proving successful on 12 per cent: grades. The stone thus cemented together cannot be dislodged, as in macadam. It does not grind under traffic. It does not get dusty in dry weather. While it is made of hard stone which gives it greater wearing qualities, yet, in as much as each of these stone particles is encased in a soft cement, the pavement is very quiet.

As the public becomes acquainted with its qualities, it grows in popularity. It is reasonable in cost, and from a scientific standpoint, has the endorsement and approval of leading municipal engineers and officials from over the entire country.

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## WOOD PAVING SPECIFICATIONS IN GREATER NEW YORK.

*By F. A. Kummer, New York.*

The work of wood paving in Greater New York may be broadly divided into two general classes. First, ordinary street paving work; second, bridge floors.

The street work in question comprises a number of streets recently finished in the borough of Brooklyn, including a street in the Navy Yard, and several streets in the borough of Manhattan, on which bids are now being asked.

The bridge work referred to comprises the Washington-ave. bridge, the Metropolitan and Meeker-ave. bridges over Newtown creek, and the new East river bridge between New York and Brooklyn, the latter having an area of 12,410 square yards.

Most of the streets in question have a considerable, and two, heavy travel. The specifications for concrete are as follows:

The concrete shall be made of the best quality of Portland cement, samples of which must be submitted at least ten (10) days (Sunday and holidays excluded) before using, for the inspection and approval of the chief engineer. All cement shall be of a uniform quality, color and weight, and briquettes of one (1) square inch section shall develop or exceed the following tensile strength:

| | Pounds. |
|---|---|
| Neat—Four hours in moist air, twenty hours in water | 200 |
| Neat—One day in air, six days in water | 400 |
| One of cement, three of sand, one day in air, six days in water | 150 |

The concrete shall be composed of one part cement, three parts sand, and six parts broken stone. The unit of measure shall be the barrel of cement as packed by and received from the manufacturer.

The sand shall be clean, coarse and sharp and be free from loam or dirt. The broken stone shall be of trap, granite or limestone, or such other stone taken from the line of work as shall be satisfactory in the judgment of the engineer. It shall be entirely free from dust and dirt, and be of graded sizes, such that all will pass through a revolving circular screen having holes two and one-half inches in diameter and be retained by a screen having holes one-half inch in diameter; provided, however, that equal parts of broken stone and clean-washed gravel of a size and character satisfactory to the engineer may be used. The sand and stone shall be placed upon broad platforms and be kept free from dirt, and the cement shall be properly mocked up and protected from dampness.

The sand and cement shall be mixed dry, then made into mortar by the addition of water, when the broken stone shall be added and the whole mass thoroughly mixed. The concrete shall then be spread upon the sub-grade and rammed so as to fill all the voids of the stone with mortar and bring the surface exactly three inches below the finished pavement. If a machine be used for mixing, the above operation may be varied as may be required. No concrete shall be used that has been mixed more than one-half hour. The concrete shall be protected from the weather when deemed necessary by the engineer.

No horses, carting or wheeling shall be allowed on the concrete before the same has set, except on planks furnished and laid by the contractor.

The following are the specifications for the wood block and the method of laying same:

The wearing surface shall be composed of long-leaf, all-heart, yellow pine blocks, treated as hereinafter described. All blocks shall be of sound timber, free from bark, sapwood, loose or rotten knots, or other defects which shall be detrimental to the life of the block or interfere with its laying. No second-growth timber will be allowed.

The blocks are to be treated throughout with an antiseptic and waterproof mixture, at least 50 per cent. of which shall be dead oil of coal tar, commonly known as creosote oil. The remainder to be resin or some other similar and suitable waterproof material. All portions of each individual block shall be thoroughly treated with the mixture, and after treatment the specific gravity of the blocks shall be greater than that of water.

After treatment the blocks shall show such waterproof qualities that, after being dried in an oven at a temperature of 100 degrees for a period of twenty-four hours and weighed, the gain in weight shall not be greater than 3 per cent.

In preparing the blocks to receive the creosote mixture, they shall be placed in an air-tight cylinder in which dry heat is maintained and raised to a temperature of 215 degrees F. for one hour, for the purpose of expelling moisture, the heat being maintained until the block is completely sterilized. Application of heat is then to be stopped and the temperature of the cylinder allowed to fall for one hour or until the same has been reduced to 250 degrees. A vacuum shall then be applied until about 26 inches is reached, and while under this vacuum the creosote mixture shall be run into the cylinder at a temperature from 175 to 200 degrees, after which hydraulic pressure of not less than 200 pounds per square inch shall be maintained until the individual blocks are treated throughout.

Upon the surface of the concrete foundation shall be spread a bed of cement mortar one-half (½) inch in thickness; this mortar surface shall be composed of slow-setting Portland cement and clean, sharp sand, free from pebbles over one-quarter (¼) inch in diameter and mixed in the proportion of one part cement to four parts of sand. The mortar top shall be "struck" to a true surface exactly parallel to the top of the finished pavement.

The blocks shall not be less than 2½ inches wide, 7 inches long and 3 inches deep, or 3 inches wide, 8 inches long and 4 inches deep, uniform in depth or thickness. They shall be laid with the grain vertical and at such angle with the curb as the engineer may direct. They shall be laid in parallel courses with as tight joints as possible, each block being firmly imbedded in the mortar bed so as to form a true, even surface. The joints shall then be filled and kept filled with clean, fine sand.

It is of course evident with this class of bed that the blocks must be cut to an even length. On one of the several streets paved by the company with which the writer is connected some difficulty was experienced because a certain proportion of the blocks were not cut to even depth. This was due to an error in shipment from the works, and for a time delayed the work and showed the absolute necessity of having the blocks uniform in depth. In the writer's opinion, this form

of construction is far superior to the sand cushion. Such a mortar bed adds to the strength of the base, which a sand cushion does not. It admits of no shifting, and if the blocks are tightly and firmly bedded and set in the mortar while moist, it is impossible for any moisture to get under them. It is, of course, absolutely inelastic and would not make a proper foundation for inelastic paving material, such as brick or stone, but wood block being in itself very elastic does not require a cushion between it and the concrete. It is an advantage to the contractor because it does away with the rolling of the pavement, although, as before mentioned, it makes it necessary to use blocks of absolutely even depth, within, of course, very slight variation. Our experience showed that a variation of possibly one-eighth of an inch in the depth of the block would be taken up by the cement bed, but not more than this, as this mortar does not compress very much and the broad, flat surface of the base of the block does not cause the mortar to flow sidewise as it is not mixed sufficiently wet for this. If it were, it would be impossible to keep the blocks from sinking to the surface of the concrete by their own weight, or by the weight of men standing on them while paving.

All of the streets referred to above, with the exception of the one in the navy yard, were paved with blocks four inches deep, and the joints filled with sand. In the opinion of the writer, on streets having any travel to speak of laid with four inch block no better joint than a good sand joint can be secured. The action of the sun draws a small amount of resinous and oily matter from the wood, and this unites with the sand between the blocks and ultimately makes a mastic and perfectly water-proof joint.

The street in the navy yard presented an exceptional case. Very moderate travel was anticipated on the street and it was laid with blocks three inches deep, upon a sand cushion. These blocks were two and one-half inches wide and six inches long, and owing to their small size and the manner in which the cushion was made, it was deemed advisable to fill the joints of this street with paving pitch, which was done, thereby excluding all moisture from the sand cushion.

With reference to the size of the blocks, the standard size at first adopted for this work was a block four inches wide, four inches deep and eight inches long, and the blocks for lighter travel were two and one-half inches wide, three inches deep and six inches long, and in some cases eight inches long. It was soon found that there was a tendency on the part of careless workmen to lay the four-inch block with the grain horizontal instead of vertical, the block being four inches in each dimension, and for this reason, as well as because a better grade of lumber may more readily be secured in the smaller sizes, it was decided to change the standard size to a block three inches wide, four inches deep and eight inches long. So, while the length and depth of the block remain the same, the width was reduced from four to three inches. Such a block cannot be laid the wrong way in the street, and while it presents more joints to the square yard, will, in the writer's opinion, make fully as lasting and a somewhat better appearing pavement. It should be noted here that the standard size block used in England is three inches by nine inches on its surface, being identical with the new standard block just referred to in width, but one inch longer. In laying narrow streets with considerable crown this one-inch additional length is a disadvantage.

The size of the block three inches deep was increased on its surface from two and a half inches to three inches wide, and from six inches to eight inches long, so that the three-inch and four-inch blocks are both of the same area on the paving surface, and both require fifty-four to lay a square yard.

With reference to the joints, the writer believes that all streets laid with sand cushion and having very light travel should have the joints filled with pitch to exclude moisture from the sand cushion.

Although some of the streets laid in Brooklyn had a considerable grade, Clinton-ave., for instance, having a grade of about 2½ per cent., smooth block was used on all of them with the exception of two blocks of State-st., where the grooved block was used.

This block is similar to the standard smooth block except that it has a groove on one edge one-quarter of an inch wide and extending downward along the joint one and one-quarter inches, so that when the blocks are placed together the plain side of each block butting against the grooved side of the adjoining block makes a joint one-quarter of an inch wide and one and one-quarter inches deep, below which the remaining depth of the blocks are solidly in contact. This joint, filled with sand, as in the case of the smooth block, allows the shoes of horses to obtain a slight foothold and obviates entirely any question of this pavement being slippery on grades. This assertion

is positively made because somewhat over two years ago several blocks of the main street in Springfield, Mass., were laid with smooth block, and for a portion of the length of the street were on quite a steep grade, somewhat over 3 per cent., and many complaints were made on the part of horse owners that the street was slippery. A contract having been awarded to the company with which the writer is connected during the present summer to pave 3,000 additional yards on said main street, the company at its own expense removed the smooth blocks from the grade in question and replaced them with grooved block, and have since been assured that all question of slipperiness has been done away with. As evidencing the slight wear of these blocks, it may be noted here that all of the block taken from this grade, which had been down two years under very heavy traffic on the main street of the city, were subsequently relaid in the 3,000 yards of work above referred to, and had worn down, or compressed so little that they could with perfect readiness be used along with the block fresh from the factory. Careful measurement of the amount of wear, or in the opinion of the writer, compression of the blocks during this period of two years, shows a uniform reduction in depth of not quite one-sixteenth of an inch, which would give the block a life of sixteen years, provided this rate of wear was maintained. Inasmuch, however, as the action of heavy traffic had been to compress the upper fibres of the block, thereby rendering them much more solid, it is the opinion of the writer that this rate of wear would not be maintained and that the paving on that street would wear almost indefinitely.

On one street laid in Brooklyn, which was a private job laid with the small block three inches deep and two and one-half inches wide by six inches long, on a sand cushion, peculiar conditions existed. After the street had been laid and the joints filled with sand, a long hot, dry spell ensued, during which there was practically no rain for fifty days, and this was immediately followed by very heavy rains lasting over a considerable period. The result was that the sand cushion under the blocks became thoroughly wet and the blocks were in effect standing in pools of water. The street had almost no travel on it and there was no tendency there for the sand to be thoroughly shaken and packed in the joints, or for the joints to become unified under travel, and the result was that a slight amount of absorption and swelling took place, spoiling the surface of the street to some extent. This section of pavement was relaid, and at that time the writer reached the conclusion that under these conditions, with blocks of such small area laid on sand cushion, with practically no travel on the street, the joints should be filled with paving pitch, and subsequently, as above stated, this was done at the work in the Navy Yard with perfect results.

No evidence has ever yet been found of any blocks four inches deep on streets of any travel at all being affected by moisture. And even with the explanation above made, the writer is somewhat at a loss to understand why this particular street acted in just the way it did.

The streets in the borough of Manhattan for which bids are now being asked for paving with wood block are Warren-st., from Broadway to Greenwich-st., 4,790 square yards; Twentieth-st., from Broadway to Fifth-ave., 1,000 square yards; Ninety-eighth-st., from Central park west to Amsterdam-ave., 5,490 square yards.

The principal streets paved in Brooklyn this year were Clinton-ave., Gallatin-place, Monroe-st., Java-st. and State-st., the work on the latter street being a continuation of that done on the same street last year.

The bridge floors laid with wood block above referred to were laid in two different ways: The small bridges enumerated were all laid on creosoted plank decks, three inches thick. These decks were all in place and had been in place for some years before the wood blocks were placed upon them. When the specifications for the work were being prepared it became evident to the writer that, owing to the slight warping of the planks in these decks it would not result in a thoroughly satisfactory job to lay the blocks directly thereon, but the street railroad tracks crossing these bridges were only three inches deep, and it became evident that if the bridges were to be paved with wood blocks at all they could only be paved with a block three inches deep set directly upon the planking, unless the railroad company would raise their rail, and this they refused to do. The three bridges were therefore paved with three-inch block set directly upon the above-mentioned planking, and the result anticipated has occurred, this result being that in many instances blocks which do not lay firmly on the planking have been cracked by the extremely heavy traffic, one of the bridges alone having over 4,000 heavily loaded teams per day. At the same time the surface of these bridges

has been perfect, and the cracking of individual blocks has not apparently injured the integrity of the pavement in any way. The blocks being thoroughly treated throughout, the admission of moisture or air containing germs of decay to the heart of the block is of no importance and the paving being laid very tight, presents a smooth surface, resembling very much that of asphalt, so that the joints and cracks above mentioned are only apparent upon careful inspection. At the same time, the writer cannot recommend this form of construction except in cases where it cannot in any way be avoided. A number of other bridges, notably in Lowell, Waltham and Chicopee, Mass., and Baltimore, Md., and elsewhere, have been laid with wood block during the year, both three inches and four inches deep, and in a majority of cases it was found desirable to cover the decking of the bridge with a coating of paving pitch, applied hot, upon which was spread a light sand cushion of sufficient thickness to take up any inequalities in the planking. The object of applying the pitch to the decking before putting on the sand cushion was to prevent the sand cushion from running through the cracks between the planks, as would otherwise have been the case.

Work on the new East river or Williamsburg bridge is under way at the present time. These blocks are four inches deep, and of the 12,410 square yards embraced in the structure over three-quarters of the area will be laid with grooved blocks. These grooved blocks extend from the anchorages up to a point 300 feet from the center of the bridge. The blocks on this portion of the bridge are grooved because of the grade. The 600 feet directly in the center of the span being approximately level, is laid with the plain block. The paving surface is set directly upon the steel floor, formed by laying 3x12 channels side by side and lengthwise of the bridge. These channels rest directly upon the floor beams of the structure and are laid about one inch apart and are fastened to each floor beam with a bent plate. Across the tops of these channels at right angles to the line of the roadway every ten feet are bolted one-quarter-inch angle irons, two inches on the flat and one inch high, two horizontal legs turned toward the center of the bridge from each end. The purpose of these angles is to divide the pavement in ten-foot sections so that should any expansion occur it will be confined within each section. These angles are bolted by means of bolts passing through the slots between the channels, which, as I before stated, are separated about one inch. It is intended to pave each ten-foot section separately, and when it has been paved to close it up by means of the angle irons, these irons being driven tightly against the last course of block in each section and bolted into place. The first course of block in each ten-foot section is grooved so as to fit over the leg of the angle iron. In this way each ten-foot section of each roadway, of which there are two, is made an independent area. While there is no probability of any expansion occurring, still should it occur it would be confined to each particular enclosed area.

Before laying the blocks on the steel channels the surface of same is being coated with a thick coat of paving pitch and the blocks are set in this while same is hot.

In the case of the grooved blocks the joint is filled with very fine gravel and the surface then covered with hot paving pitch, which is swept into the joints so as to fill in and around the gravel and bring the joints flush to the top of the block. The same form of filling is used on the 600-foot section of plain, ungrooved block except that no gravel is used. The whole surface of the roadway after pitching will be covered with a light dressing of fine sand.

The work of carrying out this contract has been considerably delayed by the delay on the part of the steel contractors, and it is open to some question whether the weather will admit of its completion this fall. All of the material for this work is being hoisted from the docks at the base of the middle towers by means of derricks and all of the distribution of the paving material on the structure is taking place over the completed pavement by means of pushcarts pushed by hand.

The writer is of the opinion that the specifications under which this piece of work is being done are the very best specifications which can be possibly drawn up for paving a bridge floor where it is not desired to use buckle plates. If a buckle-plate floor is used, the writer would recommend a cement mortar bed on top of the concrete used in the buckle places, with the addition of a pitch joint in case of bridges over 100 feet long, or those laid with blocks three inches deep.

# THE DEVELOPMENT OF THE KREODONE BLOCK PAVEMENT.

*By P. C. Reilly, Indianapolis, Ind.*

In Indianapolis in 1896 the first step was taken toward the present improved wooden block pavement. The blocks were cut from Washington cedar, a wood described by the Department of Agriculture as very light, soft, not strong, brittle, rather coarse grained, specific gravity .38, weight per cubic foot 23.66. The specifications for treatment required that the blocks be dipped in creosote oil. Instead of dipping, however, the blocks were subjected to the same preparatory treatment for the reception of the oil as is now employed, and the oil was injected into the blocks by pressure. But as the price of treatment was based on the process of dipping necessarily very little oil could be used, and only two and a half to three pounds of oil to the cubic foot were used, a quantity wholly insufficient for more than a brief, temporary effect. The blocks were cut 3 or 4 by 5 by 6 to 10 inches long. In the street they were laid close and then driven together, with no allowance made for expansion.

These streets, constructed of a wood entirely unsuited for paving purposes and only superficially treated with oil, are classified as creosote block. They can hardly be so termed. But the result of this very light treatment demonstrated to the city authorities that creosote oil, even in small quanities, had a most beneficial effect on wooden blocks. For these pavements, compared with precisely the same kind of pavements laid without any treatment, showed much greater resistance to wear, and for nearly five years the surface of the block remained non-absorbent to the extent that after a rain the surface remained dry and did not broom or soften, while the untreated, after a rain, immediately broomed and became soft and spongy.

The city authorities were soon to recognize that cedar was not the wood to use, and that the oil treatment was deficient in quantity. The following year the specifications were changed. Long leaf yellow pine, a wood described by the Department of Agriculture as heavy, exceedingly hard, very strong, tough, coarse grained, compact, durable; specific gravity .70, weight per cubic foot 43.62 pounds, was substituted for the Washington cedar and the quantity of oil increased to 10 pounds to the cubic foot. These specifications remained unchanged for two years, when the city again increased the quantity of oil to 12 pounds, or an increase of 20 per cent. The result of the increased quantity of oil did not give to the blocks the waterproof qualities the city expected it should, and which it deemed necessary they should possess, for when the blocks were driven close together the expansion caused the blocks to raise in spots, generally in the gutters next the curb. The cause was two-fold, the creosote oil was seriously defective in many particulars, especially in permanency, and insufficient in the quantity used. The city's judgment, however, that a long leaf yellow pine block, treated, was a most durable pavement, was fully substantiated, for the blocks in the earlier pavements show practically no wear, and what there is is very uniform. In fact, there is the wonderful record that in the many miles of streets in this and other cities there is not the slightest unevenness in wear. There is not a single block showing greater wear than the entire body of blocks, and none of the blocks show any deterioration. But, believing that 12 pounds of oil, if it were of the proper quality, were sufficient for the purpose of preservation, and for the purpose of thoroughly waterproofing the blocks, the next step by the Board of Works was an examination into and a study of creosote oil. Samples were obtained at different times from the chief distillers in the country, and frequent tests were made. It was a most important and a most fortunate investigation, both from an educational and a practical view point, for it conclusively showed that that which is known commercially as creosote oil varied greatly in quality, was extremely volatile under temperatures much less severe than that to which blocks in the street are exposed, therefore lacking in fixity and more or less soluble in water, some considerably so. The dependence that had been placed in commercial creosote oil proved to be unwarranted, and the general specification, creosote oil, would not be productive of satisfactory work. To fill the requirements Kreodone creosote oil was presented. It was uniform in quality, possessed great resistance to heat and

atmospheric influences and was very much less soluble in water than any of the others. Since then it has been made practically insoluble in water.

At the time of the introduction of this form of pavement there were no references obtainable that were of practical assistance. We had recourse to three. The creosoted block pavements in New Orleans and Galveston, the reports in the Government office on the efficacy of creosoting and the success in London and Paris and other European cities with creosoted block pavements. The Galveston and New Orleans pavements were laid with wide interstices, filled with sand—very inferior and unsatisfactory construction, 1st, because the joints were dirt gatherers and distributors, and 2nd, because blocks set apart round at the edge as does granite. We learned nothing of the expansion of the blocks because the wide joints provided for it and it was not noticeable. The Government records referred generally to the treatment of timbers, marine work, railroad sleepers, etc., but not to paving blocks.

The reports from Paris and London referred to heavily traveled streets, where in many instances the streets wear out before they could deteriorate. I have not the slightest doubt that, for a continuously heavily traveled street as is found in these cities a light treatment would suffice. The travel itself crushes the blocks to such an extent as to make them water-tight.

We had presumed, from these references, that all that was needed was to inject creosote oil into the block to protect it against decay and that then the work was done; that the blocks could be driven together in the street. Experience, quickly obtained, soon taught us that preserving a paving block was a very good thing, but it was only a part of the work to be done; the other part was that the block should be made proof against absorption.

In this connection I might suggest that creosoting wood is partly similar in intent to the tanning of hides in leather making. The proper oil has somewhat the property of combining with the fibre as tannin combines with the fibre of hides, to form a non-putresible compound. This compound may or may not be waterproof according to the circumstances, and besides the oil needed to fulfill this "tanning" of the wood fibre, enough oil should be used to fill the intercellular spaces of the wood and waterproof the block as a whole, by absolute exclusion of water from the interior of the block.

It is required that the wooden paving block be of such a character that it possesses great resistance, that the blocks be laid perfectly close together and be proof against the elements. Long leaf yellow pine is the principal wood used so far, though where fir, tamarack, elm, beech and Norway pine are more accessible either of these woods can be used. In its green state long leaf pine weighs about 58 pounds; dry about 38 pounds to a cubic foot. A cubic foot of dry timber contains 25.5 "pound volume" wood substance and 37 "pound volume" voids. One-half of these voids are in the fibres; the other half are intercellular; that is, voids among the fibres of the wood. These voids of intercellular spaces should be filled with an oil possessing not only germicidal and preservative properties but oil that is waterproof in character, that will firmly adhere to the fibre and will remain fixed in the pores. Every one of these features is essential to the success of the pavement. The resistance of long leaf yellow pine to crushing strength is about 8,500 pounds to the square inch, a resistance very much in excess of any weight or traffic it may be called upon to bear. This is its inherent strength. It is a disputed point among scientists whether the treatment of timber increases its strength or not. A celebated German scientist, Dr. Boehme, Vol. 9, 10th Census, says it does, and that the increase is about 20 per cent., but it is an unsettled question. But, considering the matter purely from the standpoint of paving, exposed to alternate wetting and drying, I should say that the fibre of the wood is not increased in strength in the treated block, but that it is so protected that it retains its inherent strength. To emphasize this point more fully, if a thoroughly dry pine block and a Kreodone block made from the same stick were placed side by side under cover and subjected to the same traffic conditions, the untreated block possibly would wear as well as the treated block; but in the street, subjected to wetting and drying, the untreated block, when wet, would become limp and very susceptible to destruction, whereas the treated block, being impervious to water, its fibres would be dry on such exposure and, therefore, would always possess their inherent strength. The theory has been advanced that some of the material used for preserving timber, because it fills the pores, supports the fibre. As the

material injected of itself does not possess any power of resistance to compression, I do not believe it adds anything to the strength of wood except in the way of protecting the fibres as I have mentioned.

I shall assume, therefore, that the strength of the wood is not increased because of the treatment, but that it simply retains its inherent strength. I will assume a dray weighing 4,000 pounds, carrying 20,000 pounds, total 24,000 pounds. The tires three inches wide and the periphery of the wheel resting three inches on the pavement, or nine square inches to a wheel. The compression on the pavement in this case, which is an extreme one, would be only 667 pounds to the square inch, or about one-thirteenth its power of resistance. If, however, the blocks be so treated with unchangeable, fixed material that will retain its strength under all conditions and for all time they will make a most durable pavement.

I have stated that there are about 20 "pound volumes" voids in the intercellular spaces of the block, which means that it will require 20 pounds of material to perfectly coat the fibres of the wood and to fill the pores, and this is the quantity I should advocate using. But, I might be asked the question, that if the Kreodone oil is waterproof and unaffected by heat and cold, and the fibres of the wood are coated with it, what possible injury could occur to the fibres, or to the constructed pavement if water did enter the pores; and again, I might be asked what would be the purpose of using a greater quantity of oil than is required to coat the fibres? I will here read a report of tests made by the city engineer on Kreodone blocks filed by two bidders last June. These tests show that blocks treated with 12 pounds of Kreodone oil were impervious to water. But there is this possibility, that if the minimum quantity of oil is used some of the fibres in some of the blocks may not be completely coated, and, therefore, using the minimum quantity we go too close to the margin of safety. If the intercellular spaces are filled with Kreodone oil we know that the fibres are not only absolutely coated and protected but that the block itself is impervious to water.

What is the Kreodone wooden block as now constructed? It is a wooden block possessing great powers of resistance, unchangeable in character, and having an absorption of moisture less than brick. In the street the blocks can be laid close together, and in this way we get the superior construction due to the edges of the blocks supporting each other, making a practically continuous surface. No pavement, not even granite, will wear as well. I do not wish to be understood as claiming that Kreodone block has as great resistance to compression as granite, or do I wish to be understood as claiming that the Kreodone block will last longer than the granite block, but I do claim that under the same conditions of traffic, because of the solid unyielding character of the granite, that the Kreodone block will remain a good pavement very much longer than the granite.

A feature which is worthy of mention is the ease with which this pavement can be repaired. In many cases, where telephone companies and others had to cut through the pavement, the replacing of the pavement has been done so skillfully that it is hardly noticeable.

Tests by city authorities for this or any other treated wooden block pavement should be made with the treated block as it is prepared for the street. It should be ascertained whether it expands or contracts under heat and cold, whether it absorbs moisture and expands, whether the oil is a fixed oil, and the gravity of the block taken to see if it has had the treatment called for in the specifications. The chemical tests necessary to be made are such as will show that the oil contains no ingredients inconsistent with true creosote oil products.

Kreodone block, as a result of experience in manufacture and public use, is now a street material which, besides possessing the conceded good points of wood, is wholly indifferent to wet, dry, heat or cold.

## THE COST OF BRICK PAVEMENTS.

*By Fred Giddings, City Engineer, Atchison, Kan.*

In the year 1887 the city of Atchison, Kan., laid the first brick pavement west of the Mississippi river. The bricks were made at Galesburg, Ill. The pavement consisted of two courses, the bottom course on three inches of sand with one inch sand cushion between the courses and sand filler. There was laid 12,982 square yards at $2 per square yard. This pavement is in excellent condition. In the year 1888 there was laid 2,470 yards of similar pavement at $2.18 per yard. A very excellent bed of shale having been found at Atchison the manufacture of paving brick was commenced and 2,704 yards of Atchison brick was laid at $2.05 per yard. Owing to the inexperience of the makers this pavement did not give good satisfaction, but with some repairs the street, which is in the business part of the city and subject to fairly heavy travel, is still giving good service. Since this time all bricks laid in the city are of Atchison manufacture. They are of excellent quality and are equal to any brick manufactured west of the Mississippi river.

Two course paving costs per square yard as follows:

In 1889, $1.856 per square yard.
In 1890, $1.915 per square yard.
In 1891, $1.683 per square yard.

In 1894 an old macadam street was repaved with one course of brick at a cost of 92 cents per square yard. This price did not include the breaking up and leveling of the old macadam and furnishing additional rock. Sand filler was used. The old macadam after being picked up was well rolled with a horse roller and the bricks were laid on a sand cushion one inch in depth. This street is in excellent condition, is subject to medium heavy travel and is fully equal to a concrete base.

In 1895 there was a demand from property owners for a less expensive pavement and it was decided to experiment with a paving consisting of one course of brick on three inch sand foundation, accordingly there was laid 3,051 square yards of such pavement at a cost of 94.1 cents per square yard. This price included the sub-grading, dressing and rolling the subgrade, and compared very favorably with the average price paid in 1891, viz. $1.683 per square yard.

The method of paving was as follows: After the street was brought to the proper sub-grade, it was rolled with a horse roller weighing about 150 pounds per inch. A sufficient quantity of sand being distributed, the sand bed was formed by dragging a guide board shaped to the contour of the street, one end resting on the curb, the other on a plank set in the center of the street. The guide board was dragged over the sand several times until the bed was firm and parallel to the finished surface, on which bed the bricks were laid at right angles to the line of the street. The pavement was then swept off, all defective bricks removed and each course forced up tight with a bar before making the closure at the curb, after which the pavement was rolled with a light roller until the bricks were brought to a smooth and firm surface. Dry sand was then broomed in until all joints were filled. The surface was then covered with one-half inch of sand and opened to traffic. This pavement is in good condition, has answered the purpose for which it was laid and the property owners are well satisfied with it.

In 1897 a street paved with cedar blocks on concrete foundation was repaved with brick, 16,521 square yards costing 69.9 cents per yard. This price included the removal of the old blocks and furnishing sufficient sand to bring the pavement to grade. Depth of blocks having been seven inches, required about three inches of sand.

One course paving cost per square yard as follows:

In 1896, 81.7 cents per square yard.
In 1898, 70.0 cents per square yard.
In 1899, 72.7 cents per square yard.
In 1900, 88.4 cents per square yard.
In 1901, 83.4 cents per square yard.
In 1902, 79.8 cents per square yard.
In 1903, 84.8 cents per square yard.

Single course brick laid on old macadam cost in 1896, 85 cents per square yard. In 1900, 84 cents per square yard.

These pavements are all in good condition with the following exceptions:

One street laid in 1900 was situated on bottom land, and owing to the bursting of a water main had been thoroughly saturated and immediately upon its completion had been subject to travel by heavily loaded wagons from a foundry, mill and other factories. In spite of frequent repairs the pavement got into such bad condition that it became necessary this year to remove the bricks and lay a

second course on the flat. Another street has also required some repairs. Bad spots have been taken up, the poor material removed and a foundation of cinders well tamped substituted.

One of the streets forms the continuation of a principal thoroughfare leading into the city over which are hauled heavy loads of wheat and corn in narrow tired wagons. A large state institution is also located on this road, over which all coal used is hauled by four-horse teams. The street is twenty-five feet wide between curbs and stands up well under this traffic.

This year there has been laid 4,728 yards of paving on sand, costing $4,008.73, an average of .84 8-10 per yard, and there is now under contract and nearly completed 12,700 yards on six inch concrete base at $1.48 per yard and 21,900 yards on broken stone foundation at $1.13 per yard, both repressed brick. The latter is of a minimum depth of six inches broken stone, size two and one-half inches, the voids being filled with limestone screenings and well rolled with a fifteen-ton roller. This makes a first-class foundation, almost equal to concrete at 35 cents less per yard. However, there was considerable macadam on the street which reduced the cost. We have lately let contracts at $1.27½ cents on old concrete foundation, which will be raised on an average of five inches, with broken stone and screenings, Portland cement filler with expansion joints; also two course paving at $1.447 and on broken stone at $1.195.

The price of paving brick is $11 for repressed and $10 for common pavers at the kiln. The cost of hauling is from 75 to $1 per M.

In conclusion I would say that one course brick paving on a sand foundation makes a cheap, durable and satisfactory pavement for residential streets of moderate traffic, when the soil is suitable. Such pavements may be laid on steep grades. We have one street with a grade of 13 per cent. This type of pavement should not be laid on flat bottom lands where the soil is unstable. I am of the opinion it would be well to substitute for the three inch sand foundation three inches of cinder well rolled with one inch sand cushion. I found in taking up the failed pavement previously mentioned, that the place where repairs of cinders had been made were extremely hard and difficult to loosen with a pick.

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## THE PASSING OF THE COBBLESTONE.

*By Geo. W. Tillson, Engineer of Highways, Brooklyn, N. Y.*

The first pavement laid in this country was in Boston about 1650, and in New York in 1656, the material in both cases being cobblestone, and this material has been used more or less as a paving material for the streets of this country ever since, so much so indeed that at one time Philadelphia had 512 miles of cobblestone pavement, Baltimore 320 and Brooklyn 308 miles.

At the present time Philadelphia has 42 miles, Brooklyn 172 and Baltimore 320 miles, or as much as it ever had.

It is the province of this paper to treat of the decrease of the cobblestone pavement in the present borough of Brooklyn, city of New York. I quote herewith from the specifications for cobblestone pavements in that borough, taken from one of the last contracts made:

Sec. 6, Stone—The stone are to be the best selected water or bank paving stones, of a durable and uniform quality.

No stone shall be less than four (4) inches, nor more than eight (8) inches, in any direction on the surface, and not less than six (6) nor more than ten (10) inches in depth, and in case any stones are furnished which do not comply with this specification, they will be rejected.

No triangular or split stone will be allowed; all stones shall be set perpendicular and on their small ends; the large stone to be placed on the sides of the street, and the small ones in the center or crown, with a proper graduation of sizes between.

Probably all of the cobblestone pavements in Brooklyn were laid upon similar specifications. When the pavements first began to be laid it was a comparatively easy matter to obtain stones that approximately conformed to these requirements, but as they came into use the stock of good stones was used up, and then stones of practically all sizes and shapes were used instead of true specification stones. It was a common occurrence to find in the city of Brooklyn in the alleged cobblestone pavements stones

that would be from fifteen to eighteen inches long and from ten to twelve inches wide and rough and irregular on top. The writer in one case measured a stone in one street that was three feet long and eleven inches wide. At another time when a certain street was being repaved with granite blocks, a bowlder was discovered among the cobblestones, so large that it had to be blasted before it could be removed. This was evidently on the street when it was originally graded, and simply lowered down to conform to the grade of the new pavement.

GEO. W. TILLSON, Sec'y A. S. M. I.
Engineer Bureau of Highways, Brooklyn, N. Y.

The greatest amount of cobblestone pavement in Brooklyn was on the 1st of January, 1888, and it decreased regularly until 1901, remained stationary until 1893, and then increased a little until 1895, since when its decrease has been constant.

In 1888 cobblestone was practically the only paving material in Brooklyn. At that time there were less than twenty-five miles of granite, only eight miles of asphalt, and only fifty miles of all pavements other than cobble. These other pavements have increased rapidly. On the 1st of January, 1903, there were seventy-three miles less asphalt than cobble. On the 1st of October, 1903, they were only twenty-five miles apart, and if the weather be favorable the remainder of the season I have no doubt that the mileage of asphalt pavements in Brooklyn on the 1st of January, 1904, will exceed that of cobblestone. During the quarter ending Oct. 1, 1903, twenty-eight miles of new pavements were laid in Brooklyn, and when the present contracts now in force are carried out, the mileage of cobblestone will be reduced to 132 miles.

Another feature in this connection, which is very gratifying to the borough officials of Brooklyn, is that the cobblestone is being absolutely destroyed and disappearing from the face of the earth. In former years when the cobblestone was taken up from streets where new pavements were to be laid, a great part of them were used in patching up old cobble pavements, and it was quite a problem to dispose of the remainder. Now, however, they are all being broken up and used in the concrete which is being laid for the foundation of all pavements. Some repair work is being done on the cobble pavements now remaining, but the worst of them have been taken up and the new pavements have become so scattered over the city that it is possible to drive and to truck in almost any direction on a good modern pavement. Consequently, the cobblestone pavements receive very little traffic and require very little maintenance, or rather they can be endured with very little repairs.

During the past season eight large stone crushers have been engaged in crushing cobblestone in the borough of Blooklyn, and so great has been the demand for broken stone for use in making concrete that the demand for cobble for destruction purposes has been even greater than that supplied.

In working this transformation of the cobblestone into the modern pavement there are now employed in the borough of Brooklyn on an average 1,757 men and 386 teams. If to these could be added the number of men who are engaged in the manufacturing of materials used in this work the number would be increased fully 50 per cent.

# ASPHALT PAVEMENTS AND THEIR MAINTENANCE IN ROCHESTER, N. Y.

*By W. J. Stewart, Assistant City Engineer.*

Asphalt pavements in the United States date from 1876, Washington being the first to lay them. Their popularity began to spread over the country from this time until we have now over 30,000,000 square yards in over 130 cities. Rock asphalt was first used in Paris in 1854, and was laid on the principal streets and avenues. Many miles of splendid pavements have been laid in each of these cities, but some poor ones have also been laid. This has led to a great deal of criticism of asphalt and has made the question of guaranty and maintenance a much debated one.

The cost of maintenance in other cities has been greater than the experience of Rochester has shown to be necessary there. Thus, Washington has paid for repairs three cents per square yard for the first five-year period and eight cents for the second five-year period for the wearing surface. Buffalo, six cents for the first and five cents for the second period. Cincinnati, seven and one-half cents for the first and four cents for the second. Omaha has a contract for ten years at eight cents per square yard per annum, and Denver at ten cents. New York and Washington pay for repairs to the wearing surface by the cubic foot measured in the carts on the streets, the price last year being ninety cents per cubic foot. One advantage of this plan over all the others is where the wearing surface is reduced in thickness from traffic only the amount of asphalt necessary to repair the hole is paid for instead of the standard thickness fixed in the contract.

The European plan seems to be to pay a fixed amount per square yard per annum on the whole area of the pavement, and not on the area actually repaired. The periods of guaranty vary from five to fifteen years, five years being more often used.

Asphalt pavements in Rochester date from 1885, the length of guaranty on some streets being five years, and ten years on others. The character or location of the street had nothing to do with the length of guaranty. Since 1897 ten years has been the length of all guaranties. In 1901 the common council passed a general ordinance which provided for a uniform guaranty of ten years on all kinds of pavements. For asphalt pavements the ordinance provides as follows:

The asphalt surface in sheet asphalt pavements shall be composed of one of the standard mixtures laid in this city for the past five years, or any other asphalt mixture that has been laid in quantities of at least 3,000 square yards, and has worn well for a period of not less than three years. It shall be laid upon a concrete foundation. Asphalt block pavement shall be constructed of asphalt, and laid upon a concrete foundation.

These pavements shall be laid under a guaranty of at least ten years' duration, said guaranty to be protected by a cash reserve of at least 10 per cent. of the amount of the final estimate for the asphalt pavement, and in addition thereto, of a good and sufficient bond to the amount of not less than 40 per cent. of the estimated cost of the asphalt pavement.

Our pavements have been laid by four different companies, the Warren-Scharf Asphalt Paving Company laying the Trinidad Lake, the Rock Asphalt Pavement Company, the German and Sicilian natural rock, the Rochester Vulcanite Pavement Company, the vulcanite, and the firm of Whitmore, Rauber & Vicinus, the Trinidad. Since 1892 the Vulcanite Pavement Company has laid only Trinidad Lake.

The first pavement laid was on a fine residence street with considerable traffic, having a roadway 38 feet wide and an area of 10,240 square yards. After a service of eighteen years this pavement is in good condition. The average cost per square yard for the years it has been maintained by the city has been 2.2 cents. It was guaranteed for five years, but nothing was spent on it until the eleventh year. The street had very little grade, and $1,287 was spent in 1897 for repairs to the gutters, which were badly rotted by water standing therein. This pavement was Trinidad Lake asphalt.

The first rock asphalt was laid in 1886. The repairs required were very small, and they were maintained by the company at its own expense until 1898.

The appended table from our Annual

Report for 1902, showing the cost of repairs to asphalt pavements paid by the city, gives some very interesting figures in the maintenance of asphalt pavements at a minimum cost. It includes none of the pavement in the tracks of the Rochester Railway Company, nor for 2 feet outside of the tracks, as that is charged to said Company. The cost will be found generally quite low, with a few exceptions. West-ave. shows an average cost per square yard for the years maintained of seven cents. This is one of the main streets of the city, and the pavement one of the first built. A double line of tracks originally poorly laid. This pavement was about a mile in length, 1,300 feet of which, carrying a very heavy traffic, was continually in need of repairs, and no matter how often the holes were repaired it was but a short time before it was in need of as much more. This year this portion was taken up and a Medina block stone pavement laid in its place. In making the excavations for the new pavement all underground constructions, such as water and gas pipes, sewers, electric subways, etc., were examined, and the gas pipes which lay on both sides of the street were found to leak badly. The ground was completely impregnated with gas in many places. This softened the asphalt and was probably the cause of the trouble with the pavement.

Another street which shows a rather high rate is Spring-st., at 9½ cents. This is also a business street with heavy traffic.

Division-st., showing a cost of 17 cents, is only a small amount of 300 yards over an area-way, and was almost entirely replaced.

Chili-ave., at 5 cents, is another street of which there is no doubt of the poor quality of the asphalt. Though this is in the suburbs, it has a comparatively heavy traffic. All the rest of our streets have cost much less than these, many less than 1 cent.

The average cost for maintenance per year has been as follows: 1897, when the first contract for general repairs was let, 4.21 cents; 1898, 2.20 cents; 1899, 2.34 cents; 1900, 2.11 cents; 1901, 3.17 cents; 1902, 4.72 cents.

The total amount of asphalt pavement in the city is as follows:

| | |
|---|---|
| Trinidad Lake | 23.972 miles. |
| Trinidad Lake | 4.404 miles. |
| Rock | 11.355 miles. |
| Vulcanite | 6.805 miles. |
| Total | 46.536 miles, |

or 762,731.3 sq. yds.

Total number of square yards on which the guarantees have expired, 450,907.

Total number of square yards still under guarantee, 311,824.

The following table shows the average cost per square yard and the length of guaranty for each year since asphalt has been laid in Rochester:

| Year. | Guarantee. | Cost per square yard. |
|---|---|---|
| 1885 | 5 years | $2 50 |
| 1886 | 5 years | 2 73 |
| 1886 | 10 years | 2 65 |
| 1887 | 5 years | 2 15 |
| 1888 | 5 years | 2 75 |
| 1889 | 5 years | 2 78 |
| 1889 | 10 years | 2 75 |
| 1890 | 5 years | 2 75 |
| 1890 | 10 years | 2 75 |
| 1891 | 5 years | 2 70 |
| 1892 | 5 years | 2 55 |
| 1893 | 5 years | 2 65 |
| 1893 | 10 years | 2 60 |
| 1894 | 5 years | 2 60 |
| 1894 | 10 years | 2 65 |
| 1895 | 5 years | 2 51 |
| 1896 | 5 years | 2 19 |
| 1897 | 5 years | 2 43 |
| 1897 | 10 years | 2 45 |
| 1898 | 10 years | 2 26 |
| 1898 | 15 years | 2 60 |
| | (The only fifteen-year guarantee.) | |
| 1899 | 10 years | 2 04 |
| 1900 | 10 years | 2 26 |
| 1901 | 10 years | 2 02 |
| 1902 | 10 years | 1 74 |

All asphalt pavements are now laid on a six-inch concrete foundation, with one inch of binder and two inches of wearing surface.

The demand for brick pavements has brought down the price for asphalt lately, our bids being about the same for each.

It will be seen that local conditions have fixed prices, rather than the length of the guaranty period, and our experience leads us to believe that with a well-built pavement on a street of ordinary traffic without tracks, very little repairing will be required in ten years. There is no way of knowing whether the cement or sand has been overheated before mixing at the works, or whether the proper proportions of cement, sand and stone dust have been used in every mixture. If an expert inspector is on the street he may prevent a poor binder with too much tar in it from being laid on a concrete foundation that is too green, or with his thermometer see that the asphalt is not too cold, and also that the compression is right at all points. Contractors, through having complete control of the material and the manipulation of it, still sometimes build a bad pavement, so that it does not seem unreasonable to demand a guaranty of this length.

In this connection the following quotation from a discussion before the American Society of Civil Engineers on the subject, "The Maintenance of Asphalt Pavements," by Mr. Nelson P. Lewis, chairman of our committee on street paving, is very interesting at this time:

But conditions are changing in a large city like New York, and they are changing for the better, and account should be taken of the changes. Steel tires are wider than they were, a large proportion of them have been replaced by those of rubber, horseshoes are lighter, and one will not discount the future properly if he does not take into account the large percentage of horseless, smooth-wheeled vehicles which will be found on our streets before a ten or a fifteen-year contract made at the present time will have expired. All these changes will tend to simplify the problem of maintaining our asphalt pavements. The elements most injurious to them are constantly being eliminated.

The method adopted in Rochester for making repairs is as follows:

Each year bids are received for resurfacing, including the concrete foundation, also for resurfacing only, by the square yard. Skimming was practiced in the years 1897, 1898 and 1899, and then discontinued as not being satisfactory. The price bid the first year that skimming was tried was $1.60 per sq. yd, the second year $1.40 and the third and last year $1.25. The price paid in 1902 for resurfacing with Trinidad was $1.65, and including the concrete, $2.38. For resurfacing with rock, $1.65, and including the concrete, $2.50. The price this year for resurfacing with Trinidad was $1.28; including the concrete, $1.88. For resurfacing with rock, $1.44; including the concrete, $2.29.

One man from the city engineer's office has supervision over all the repairs and directs an inspector who goes over a street with the contractor marking such places as must be repaired. The contractor is not allowed to cut out any more than is determined necessary by the inspector. After the street is repaired the patches are measured and located by our representative, and the contractor proceeds to the next street to be repaired. The general repairs are made in the spring, and some in the fall.

## STREET RAILWAY AND INTERURBAN TERMINAL OF INDIANAPOLIS.

*By T. B. McMath, Engineer Indianapolis Traction and Terminal Company.*

The street railway system of Indianapolis had its beginning in an act of the legislature of the state approved June 4, 1861, which provided for the incorporation of street railway companies.

The citizens' Street Railway Company incorporated under the act in January, 1864, with a capital stock of $100,000, and construction followed and transportation facilities were provided for a district of seven square miles. By the year 1886 there were twenty-one and a half miles of track in operation.

The street railway of Indianapolis has always been developed as a system of lines radiating from the business center. The intersection of Illinois and Washington-sts. being the radiating point. The lines are operated so that in making a round trip every car in the city passes this point during the trip. Lines having a short time interval between cars make a loop in the vicinity of Illinois and Washington-sts.: other lines with a greater interval are operated as double lines, that is the car starting from an outer terminal passes this common point on its way to a terminal at some other outer point in the city. This point of intersection is the place of general transfer.

Mr. Hugh J. McGowan came to this city in 1898 and organized what was known as the Indianapolis Street Railway Company.

The equipment consisted of 100 miles of track and a plant capable of furnishing 2,000 horse power, and operating 200 cars.

The Indianapolis street railway franchise is a contract with the city of Indianapolis authorized by an act of the State Legislature. The prominent features of the contract between the city of Indianapolis and the Indianapolis Street Railway Company were:

1. The rates of fare—six tickets for 25 cents and 25 for $1, that is four-cent fare, with the privilege of a transfer permitting the passenger a continuous ride on any other line on the system.
2. The giving to Board of Public Works a general supervision over the execution of the contract.
3. The obligation to pave and maintain the space between the tracks and a space 18 inches outside of the outside rails of all tracks.
4. The service to be provided to be efficient and first-class.

The obligation to pave the tracks has for the past four years required an an-

nual expenditure of $300,000, and is in charge of a special department under the civil engineer. The kinds of paving have been asphalt, brick, creosoted wood block, macadam, and gravel. Our experience in this department has shown brick to be the most satisfactory. The streets of the city are generally wide with ample room for the wagon traffic outside of the tracks, hence asphalt laid in the track has never had sufficient work to keep it elastic, and therefore the pavement has become brittle, and vibration due to the cars has cracked it and loosened it from the concrete base. We have found it advisable to lay brick stretchers along the rails to overcome this difficulty. Creosoted wood block after three or four years begins to absorb moisture—swelling follows, resulting in the destruction of the track, it being utterly impossible to maintain the correct gauge, material changes in the gauge taking place in a few hours. Brick makes a good appearing street and under the traffic conditions existing in Indianapolis is very satisfactory.

The former standard of track construction was a nine-inch girder rail of Philadelphia type, and weighing ninety-three lbs. to the yard, on ties spaced two feet apart, with gravel ballast, or on ties spaced eight feet apart, and a concrete beam twenty inches wide and extending nine inches under the rail.

The Indianapolis Street Railway Company upon taking possession of the Citizens' Railway Company began the task of rebuilding and modernizing the property. The capacity of the power house has been increased three fold, making 6,000 horse power. The overhead wire system has been entirely rebuilt. Forty miles of track has been rebuilt and twenty miles of extensions added. The old rolling stock of short cars, termed by the people of Indianapolis, "dinkeys," has been discarded. The rolling stock now on the streets of Indianapolis is all less than four years' old. We think that we have in our large cross seat double truck car the best city passenger car in this country. The people of Indianapolis have, in five years, changed from speaking of their car service with supreme contempt to actually bragging that it is the finest, without exception, in the country.

In 1900 the Indianapolis Street Railway Company provided terminal facilities for the first interurban line, the Greenwood. This was quickly followed by the Greenfield line and the Union Traction Company. The large, heavy cars of the Union Traction Company demonstrated the necessity of special track construction to accommodate interurban traffic.

Interurban cars to run at a fair rate of speed must use wheels with a larger flange than formerly used for city traffic, and of necessity the cars are larger and heavier. The only rail adapted for this traffic in city streets is a high "T" rail. The College-ave. line in this city, on which the Union Traction Company cars operate, was rebuilt last year with a seven-inch Shanghai "T" rail on ties spaced two feet apart, and ballasted with six inches of concrete under the ties, the concrete being carried up to within five inches of the top of the rail, the average thickness of the concrete being fourteen inches, the street surface being vitrified brick on a sand cushion. A special shaped nose brick was used adjoining the rail to form a groove for the wheel flanges.

The rapid development of the interurban lines brought with it the necessity for proper terminal facilities. By joint agreement between the city of Indianapolis and the interurban companies of 1902, and the Indianapolis Street Railway Company, the Indianapolis Traction and Terminal Company was organized, and in August, 1902, entered into contract with the city of Indianapolis to provide terminal facilities for all interurban lines, with authority to secure by lease, or purchase, the Indianapolis Street Railway Company. In January, 1903, the Traction & Terminal Company secured a lease of the Indianapolis Street Railway Company. The contract of the Traction & Terminal Company provides for the construction of a terminal station for passengers, a freight station, and the necessary tracks and connections thereto.

The congested condition of traffic on Pennsylvania, Washington and Illinois-sts., which comprise the retail district of the city, rendered it necessary to construct tracks for interurban traffic to avoid these congested streets in reaching the station. Ground was secured for the Interurban station by the purchase of the south east quarter of the block bounded by Illinois-st., Ohio and Market-sts., and Capital-ave. The general project of the interurban station was to occupy the Illinois-st. frontage of the quarter block with a fine nine-story office building, through which should be the entrance to the train shed, and which should contain waiting rooms, and all possible conveniences for the traveling

public, the remainder of the property to be occupied by the train shed.

The tracks will enter the train shed from Market-st., and will be nine in number through the station, and converging into two tracks before reaching the exit at Ohio-st.

Provision is made to reach the station by the construction of tracks with the proper connecting curves, on Delaware-st., Ohio-st., Capitol-ave., and Maryland-st. These streets provide therefore a rectangular loop enclosing twelve city blocks, which encloses the retail business district. Interurban lines upon reaching this loop may proceed to the station by the most direct route, or in case of blockades, reach the station by going around this loop in the opposite direction.

It is sufficient to say, in describing this station, that it was designed by D. H. Burnham & Company, of Chicago, and is being erected under their supervision. It will cost about one and one-half million dollars. No feature that could add to the convenience or comfort of the traveling public, or other occupants of the building, has been omitted.

The construction of the loop by which the interurban cars will reach the station will be of the most permanent character. A special rail has been provided, seven inches in hight, weighing ninety-one lbs. to the yard. This rail will be laid on a heavy concrete beam, and anchored to the beam at intervals of four feet. At practically every street intersection along this loop are contemplated curves, and connecting tracks made of the heaviest construction. The contract for furnishing these curves and the special work has been let to the Lorain Steel Company. Eight of these intersections will cost $14,000 each, which gives some idea of the quality, and magnitude of the work to be done. New work is now being installed at Pennsylvania and Washington-sts., and is a good example of the intricate work required.

An interurban railway company entering Indianapolis must make a contract with the city, through the Board of Public Works. The existing contracts provide for a five-cent fare on interurbans inside the city limits, without transfer; also a description as to route to be taken to the station, permit carrying mail, baggage, package freight, merchandise—to be unloaded only in a station; provide that freight rates shall not exceed those charged by common carriers, nor be less than 80 per cent. of steam railway freight schedules, and pay a car tax of 1 per cent. for each round trip per car, inside the city limits.

The Traction & Terminal Company's contract provides that it shall pay a car tax on interurban cars for the first eleven years of 4 cents per car, round trip, for all interurbans, four-fifths of whose route in the city is on its tracks, and which enters the terminal station. The next ten years this tax will be 6 cents per round trip, and 9 cents for the balance of the life of the present contract.

Indianapolis is a pioneer in the solution of the problem of terminal facilities for interurban companies. We feel that in providing this union interurban station, located in the business district of the city, we have solved this problem, and will unload our passengers where they may transact their business, within one block of the State Capitol, the Soldiers' Monument, and in close proximity to the markets and the railway station.

The building will be one which may be displayed to visitors with pride, not only for the architectural beauty, but as the first union interurban station.

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## SANITATION OF PUBLIC AND INDUSTRIAL BUILDINGS.

*By Prof. Severance Burrage, Purdue University, Lafayette, Ind.*

Sanitation, or sanitary science, or practical hygiene, may all be classed as preventive medicine. They have to deal with preventable diseases on a large scale; that is, they do not deal with the health of the individual, but with communities or collections of individuals. The preventable diseases are mostly germ diseases, caused by micro-organisms that we call microbes or bacteria. If we study a vital statistics table we will find that only about 4 per cent. of the deaths are due to old age. The other 96 per cent. are due to some abnormal condition of the body which we call disease. A large majority of these deaths from some form of disease might have been prevented had the proper sanitary precautions been observed.

Sanitation attempts the prevention of

germ diseases in two ways. First, by the removal of the germ from the environment, and second, the removal of the conditions which render people susceptible to these germ diseases. Sanitation deals with both of these methods; and the sanitation of buildings deals also with both of these methods. Consider, for example, the sanitation of buildings under the first method of prevention, the removal of the germs. Here we have to do with the cleanliness of the building, the methods of sweepinig and washing the floors, the washing and distribution of towels to the toilet rooms, etc. And considering sanitation of buildings under the second method of prevention; that is, attempting to keep the bodies of people non-susceptible to the germ diseases, we have ordinary hygienic precautions, ventilation, heating, lighting, plumbing, drainage, sewerage, water supply and in fact everything which pertains to the comfort and health of the occupants of the buildings.

I have made a rough classification of public and industrial buildings, as follows: The group public buildings includes hotels, theaters, railroad stations and some stores; schools, town and city halls, various public institutions as hospitals, asylums and prisons. Industrial buildings include factories, sweat-shops and certain stores in which there is some manufacturing or repairing going on. First, let us consider the public buildings. The first group of public buildings, which includes hotels, theaters and railroad stations in our large cities, exhibits many good examples of buildings in which the sanitation has been well looked after. The reason for this is evident. They seek patronage and the cleanest, best regulated, best ventilated, most comfortable in every respect, hotel or theater, will have the largest patronage. On the other hand, when we come to the schools and town and city halls, buildings which are put up as a rule with public money, we find that in a majority of cases little attention is given to the sanitation of these buildings. This is also true of many asylums, prisons and other public institutions. It takes a crusade on the part of the general public, after some particularly bad building is discovered, before any improvement can be made.

It is very rare that one can enter the toilet rooms of any of these last mentioned public buildings without noticing a distinct, disagreeable and usually unhealthful odor. This may be due to bad plumbing, or bad sewerage, but in nine cases out of ten it is due simply to a lack of general cleanliness. They have not had proper care and attention. The ventilation, heating and lighting of these buildings is rarely properly looked after at the time the building is constructed, and it is evident that nothing satisfactory along these lines of improvement can be done to an old building.

Let us turn to a consideration of the group of so-called industrial buildings, which includes factories, sweat-shops, etc. Here we have buildings put up by companies whose sole object is making money, with the least expenditure of money on their part. In a large proportion of cases absolutely no attention is given to sanitation in manufacturing buildings. It is only within the last few years that some corporations have begun to realize that, by the expenditure of money for the comfort and the preservation of the health of their employes, they can get more and better work out of them, and that the money thus spent is well spent.

Some notable examples of corporations that have realized the benefits to be derived from giving attention to the health and comfort of their employes are the Pennsylvania Railroad, the Elgin Watch Co. of Elgin, Ill., the National Cash Register Co. of Dayton, Ohio, and the McCormick Harvesting Machine Co., in Chicago. These are by no means all, but they happen to be the ones with which the writer is most familiar.

In some states there are certain laws in regard to the construction, ventilation, lighting of factories and manufacturing buildings. In such cases the manufacturers are forced by law to do certain things. They do not do it from the standpoint of philanthropy; they do not do it from the standpoint of economy; but the corporations mentioned above, with many others, have taken the matter up because they believe it is money in their pockets to do so. Some of them have admitted to me frankly that they would not spend money for sanitary improvements if they did not feel that it would come back to them indirectly; their employes will be more healthy, more comfortable and better satisfied, which means a great deal nowadays to the manufacturer. And in certain recent strikes, some of the complaints made by the strikers were in regard to insufficient toilet room facilities. In other cases complaints have been made relative to

the water supply, the employes being forced to drink water which was known to be contaminated and unsafe to drink.

It is a sign of advance, from the sanitary standpoint at any rate, that some of these large corporations are employing sanitary engineers for the sole purpose of looking after the sanitary conditions of the factories and surroundings, and to care for the health of the employes. The writer was employed for three months the past summer as consulting engineer for the McCormick Harvesting Machine Company in Chicago, where 6,000 men are employed, and while giving attention to many matters pertaining to the health of the employes, he gave particular attention to the water supply. The water which had been supplied to the employes was largely city water, which was acknowledged to be unsafe to drink a greater part of the time. A temporary arrangement was made by which the employes were provided with artesian well water during the hot months, and recommendations were made which provided for the supply of artesian well water all over the works all the time. The various factories connected with the above mentioned plant as a rule were not very bad from the sanitary standpoint, and yet they were far from perfect, and it is the intention of the authorities there to make improvements in the conditions as rapidly as possible.

From the fact that there are so many public and industrial buildings distributed throughout cities that do not fulfill the requirements of sanitary science, it would seem to me advisable that the cities should have a sanitary inspector of buildings, possibly connected with the board of health, just as they have plumbing inspectors, medical inspectors of school children, factory inspectors, etc. The duties of the sanitary inspector, if the office were filled by one man, which, in large cities would not be feasible, should be to look after the general sanitary conditions of the buildings, cleanliness of the toilet rooms, cleanliness of the floors, and any other facto s which would pertain to the health of the inhabitants of the buildings. It might be well to give the sanitary inspector's office several deputies, one for school buildings, one for railroad stations, one for hotels, one for factories, etc. In this way, great improvement would undoubtedly result, provided of course that the duties of the sanitary inspector could be covered by city ordinance. There should be issued, just as there is from the plumbing inspector's office, a list of plumbing regulations covering the cleanliness and healthfulness of the various classes of buildings. Then we would not be obliged to wait until a building became actually foul and filthy, which is the state they usually reach before they receive the attention and condemnation of the board of health. It is not the object of the writer to further complicate the already too much complicated machinery of city government, but he believes that a vast amount of good could be accomplished, particularly in the schools, public institutions and factories, if there should be a regular, systematic sanitary inspection of public and industrial buildings.

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## THE NEW GARBAGE DESTRUCTOR AT TORONTO, ONT.

*By John Jones, Street Commissioner.*

One of the most serious problems which every city and town of any considerable size has to contend with is the proper disposal of its waste materials classed under the general term of garbage. There are various methods employed, but at present I am only concerned with one, namely, incineration, which is the method adopted in my own city.

Toronto's experience with garbage destructors began in the year 1891. They were patterned after the Mann system, some changes of his own being made by the late Mr. Emerson Coatsworth, former city commissioner, under whose supervision they were erected, one in the east and one in the west end of the city. A couple of years ago the destructors were placed under my department, and it was decided to thoroughly remodel the one in the west end. Prior to the time I am speaking of, I had made a somewhat close study of the incinerating system, having had occasion to visit a number of cities where this system was in operation, for the purpose of examining the various kinds of destructors in use. I noted the good points of each, and my conclusion was that a destructor could be designed, which, while different from any I

had seen, would combine the distinguishing advantages possessed by those of different make. Briefly stated our new destructor is a combination of the Mann, the Thackeray and the Dixon systems. As I have already mentioned, our former destructors were built after the Mann pattern. The furnace was 30 inches long by 10 inches wide and about 7 feet high. The materials to be consumed were dumped through holes at the top directly on to the fire. At the time of its construction this destructor was considered one of the best in operation, and answered its purpose very well. There was no stench or nuisance of any kind attending its operation, and the process of incineration was thorough, but at a great cost for fuel. Its chief drawback consisted in the fact that the refuse was dumped direct on to the burning grates, consequently every fresh charge almost extinguished the fire. As garbage usually contains a large amount of moisture, it took some time for the fire to recover, which meant just that much delay in disposing of each charge. Furthermore, the sudden contraction caused by this moisture had a tendency to loosen the bricks in the crown of the furnace, and they were constantly falling out. The Thackeray system operated in Montreal is similar to the Mann, except that it is built in chambers or cells, each about 10 by 10 feet. It has, however, the same drawback mentioned in connection with the Mann, namely, the wet materials are dumped directly upon the fire.

The Dixon furnace of Toledo is doubtless well known to most of the members present, and I need not go into any lengthy description of it. Its principal feature is a system of upper carrying bars made of fire clay, on which the garbage is dried when first dumped into the furnace. As I have already stated, our new destructor combines the best features of the three systems just referred to, namely, the Mann, Thackeray and Dixon, and I think I may safely assert that it is second to none on the continent for the effective disposal of all manner of waste materials, at a comparatively small cost for fuel, etc. The measurements of the furnace over all are: Length, 35.4 feet; width, 14.6 feet; hight, 12.6 feet. The chamber is built of brickwork two feet thick, having 4½ inches of fire brick, 2-inch air space and the remainder red brick.

Mr. Jones explained in detail some drawings of the furnace which he exhibited, and he can doubtless supply copies of them to any one requesting them.

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## PERVIOUSNESS OF SEWERS.

*By Prof. A. P. Folwell, Lafayette College, Easton, Pa.*

Assuming, as is shown later on to be the case in many systems, that the infiltration into sewers equals 50 to 100 per cent. or more of the sewage proper, this necessitates larger sewers and more ample facilities for treatment. The objections to the former are two, the additional cost, and the less favorable conditions of flow during dry seasons when sewage alone enters the conduits. Since 8-inch pipe constitutes at least two-thirds of most separate systems and much of this is larger than is called for by theory, consideration of cost does not affect fully half of the pipe in such a system. Considering the total amount of each size of pipe required for a city of regular shape, having 20,000 population, 500 to the mile of sewer, all sewers on minimum grade, and assuming the cost of pipe and of handling and jointing the same (the trenching would be changed but little on account of increased size) to be 30 per cent. of the list price, the additional cost due to providing for 100 gallons per capita of ground water would be about $4,000 to $5,000. Of course in individual cases the topography might cause this to be diminished by 50 per cent. or increased by 100 per cent. The disadvantage of sewers too large for the amount of sewage reaching them is too well realized to need discussion here.

While the increase in treatment facilities need not always be proportional to the increase in sewage caused by infiltration of ground water, it must generally be nearly so. In fine sand filters it has been found that the area required depends upon the quantity of water as much as upon the quantity of organic matter to be removed. The beds at Plainfield, N. J. and at Westboro, Mass., for instance, were rendered inoperative by large volumes of ground water entering the sewer. Contact beds

if filled and discharged at fixed intervals must be of a size proportional to the total flow. It is becoming the general opinion that the cross-section area of a septic tank should be largely if not wholly proportioned to the total volume of sewage, the chief necessity being the mechanical one of securing a velocity of flow low enough to permit precipitation of the suspended matter. The increase in cost of construction due to doubling the capacity of a filter or contact bed would probably be 75 to 90 per cent. in most cases, and of a septic tank 50 to 75 per cent.

There are certain more or less important advantages connected with this infiltration. The most apparent perhaps is the drainage of the ground, which is generally admitted to be highly advantageous from sanitary and commercial points of view. But the same advantage can be obtained by underdrains without the disadvantages, except that of increased cost, the cost of underdrains being several times that of using the sewers as drains. The considerable dilution of the sewage would also tend to reduce the liability of deposits and to hasten somewhat the "natural" purification of the sewage, ordinarily effected by dilution. But if the sewage is to be treated it would tend to increase the amount of organic matter reaching the outlet of the plant, since the percentage of organic matter removed by a given process generally diminishes as the sewage becomes more dilute.

More important, however, than any of the above advantages or disadvantages is the probability that a sewer whose joints are at frequent intervals of weeks or months admitting large quantities of ground water will, during periods of low ground water, discharge sewage into the ground, polluting the ground water and causing all the evils recognized as resulting from this. (If the joints are well made and the infiltration is due simply to the porosity of the cement, nowhere exceeding say 3,000 gallons per mile, it is probable that there will be little if any pollution of the ground water.) Also, if the joints be left open at the top (but so protected as to prevent the entrance of dirt), but be tight everywhere else, this method of combining sewer and drain might not be open to this objection. But too much emphasis cannot be laid on the desirability of making joints as tight as possible everywhere except at the top and especially at the bottom, where the poorest jointing generally is found.

It would seem from the above that if the sewage is at present or at any future time to be treated, too much care cannot be taken to make the sewers tight, from a financial point of view. From the same point of view, if it is not desired to add to the cost to drain the ground, tight sewers are desirable. And the only condition under which, from any point of view, the utmost endeavor should not be made to have every joint tight is where the sewage discharges into a large body of salt or other unpotable water,

FIRST VICE-PRES., A. P. FOLWELL,
Lafayette College, Easton, Pa.

and it is desired to drain the soil, and here the only part of the joint admitting ground water should be the top, so that even in this case a material or process for obtaining tight sewers is extremely desirable.

Amount of Infiltration—About the only practicable method of measuring this seems to be to measure the flow in the sewer before any buildings have been connected to it, or at the two ends of a stretch in which there are no such connections, or to measure it in a storm sewer of the separate system when no surface water is entering. Estimates, however, have been made by comparing the relative water consumption and the sewage flow in wet and dry seasons.

The amount measured or estimated has

been expressed in terms of miles of sewer, area draining thereto and population served. No statements, to the writer's knowledge, take into account the size of the sewer, and few mention it even incidentally, and yet it seems probable that the amount of leakage is to a considerable degree controlled by the area of joints in pipe or brick work through which most or all of the water enters, except in those cases where all of the ground water reaching the outside of the sewer finds its way into it.

The following measurements have come to the author's notice:

It would, of course, be absurd to claim that infiltration within the above limits must be expected or provided for in all systems. The above measurements are most of them made because the sewer was known to leak. Records are not published of sewers which do not leak. Where there is no ground water there can be no infiltration, and there are many sections of the country and certain districts in most cities in which ground water is unknown within several feet of the level at which the sewer is placed. But in the eastern and southern states,

SEWER INFILTRATION—GALLONS PER DAY.

| City | Character | Size, etc. | Per Mile of Sewer | Per Acre | Per Capita |
|---|---|---|---|---|---|
| East Orange, N. J. | Vitrified clay | 10 to 24 in.; wet soil | 43,250 | ..... | ..... |
| East Orange, N. J. | Brick | 2x3 ft.; deep trench and tunnel, wet soil | 570,000 | ..... | ..... |
| Schenectady, N. Y. | Vitrified clay | Total system | 4,000 | ..... | ..... |
| Boston Main Drainage | Vitrified clay | Total system | ..... | ..... | 45 |
| | | 8 to 36 in.; total system | 40,000 | ..... | ..... |
| Several Massachus'ts Cities and Towns | Mostly vitrified clay | From 8 inches up; total systems | 70,000 to 80,000 | ..... | 100 |
| Norfolk, Va. | ..... | ..... | ..... | ..... | 100 |
| New Orleans, La. | ..... | Wet soil | 31,800 | 1,941 | ..... |
| Washington, D. C. | ..... | Wet soil | ..... | 975 | ..... |
| Malden, Mass. | Vitrified clay | Underdrained; wet soil | 83.000 | ..... | 110 |
| Malden, Mass. | Brick | 4 ft. and 3x 4 ft.; wet soil | 800,000 | ..... | ..... |
| English City | Concrete lined with clay pipe | 21 in. in tunnel in gravel and sand | 140,000 | ..... | ..... |
| Champaign, Ill. | Vitrified clay | From 8 inches up; entire system | 30,000* | ..... | ..... |
| Westboro, Mass. | Vitrified clay | 15 in.; wet soil; two sections | 1,320,300<br>610,000 | ..... | ..... |
| ———, N. Y. | Vitrified clay | 8 to 24 in.; wet soil | 1,300,000* | ..... | ..... |

* This amount or more.

The paper explained these cases in detail.

While these records are few in number and show considerable variation, still this is no greater than might be expected if we take into account the various conditions. They seem to indicate that in the systems in question from 30,000 to 80,000 gallons per day per mile of entire system leaked into the sewers, Schenectady alone falling below this. Where wet sections only were included the leakage into vitrified clay pipes was from 31,800 to 1,320,000 gallons per mile per day, in brick sewers 570,000 to 800,000 gallons. The leakage per square foot of submerged brickwork in the two cases—13½ and 14 gallons per day, respectively, show a remarkable coincidence, but it can be considered no more than this.

at least, ground water is found within 8 feet of the surface during rainy seasons, if not at all times, much more commonly than is realized and sewers 15 to 30 feet deep are probably more often in wet soil than not.

Since the most ground water is ordinarily found at the lowest levels where also the largest sewers occur, most of the above records for vitrified sewers in wet soil are probably for pipe 10 inches to 20 inches or 24 inches in diameter. It is to be hoped that future measurements will give the leakage into each size of pipe and also the head of water on the pipe. Exact measurements are not necessary, and those involving an error of not more than 10 per cent. need not be expensive to obtain. A standard weir, or for small quantities, a standard orifice can

easily be adjusted in manhole bottoms and the head read from a gauge permanently attached to the apparatus.

Most of the above measurements were taken before house connections were made. These are too often laid more carelessly than the sewer, and, although smaller, probably admit as much or more ground water at each joint submerged as does the sewer. Although lying higher than the sewer they are probably less likely to be submerged than it is, it is probable that in a wet season they will admit at least 50 per cent. as much water as the sewer, often two or three times as much.

In consideration of all the above it seems desirable to allow for a leakage of 50,000 to 100,000 gallons per mile per day wherever a pipe sewer is laid below the ground water level, and about 15 gallons per square foot of submerged brick sewer, except where the sewer is laid in a manner different from common practice.

Preventing Infiltration.—Probably the most common cause of excessive infiltration is carelessness of workmanship and inspection and the difficulty of making the the ordinary cement joints in wet trenches, but the most carefully made cement joints are more or less porous. However, in dry ground the ordinary vitrified clay pipe and cement joint carefully laid and proved to be so by test, would seem to be satisfactory. A test used in England is to close both ends of a section of sewer, say at the mannoles, and at a branch attach a watertight riser carried at least 5 feet above the sewer. Through this the stretch of sewer is filled and the riser also is filled, and meantime the joints are all examined for leakage; the pipe not being covered until tested satisfactorily. The writer has tested pipe from the outside in wet trenches before being covered by building a dam at each end of a stretch and allowing the ground water to rise above the pipe within the space between dams, the interior of the pipe being inspected for leaks by mirrors used as heliotropes. By discovering leaks in this way he has obtained what seemed to be tight sewers. It would seem desirable that a test similar to one of these be applied to all sewers when laid, and to all house connections, and none accepted until practically tight.

To make a tight sewer requires that both pipe and joint be tight, if pipe be used, or that the material of which the walls of a sewer be constructed be tight, if the sewer be built in place. Probably the surest way to make a tight sewer is to use cast iron pipe and lead joints, but this is expensive, even when the lightest weight iron pipe is used. With pipe at $30 per ton, 8-inch iron pipe sewer would cost about 40 cents per foot more than vitrified; 12-inch, 70 cents more; 18-inch, $1.10 more; 24-inch, $2.00 more; a very considerable increase. However, where the ground is wet and liable to slight settling or jarring probably cast iron pipe is the best construction. Wrought iron pipe has not, as far as the author knows, been used for sewers, but it seems probable that where it would be more desirable than cast iron as a water conduit under light pressure, it would be as a sewer also, except where there might be considerable erosion.

Wood pipe, either bored logs or wood stave, can be made practically tight, but if untreated would be too absorptive for general use, becoming soaked with putrid sewage. But creosoting probably removes this objection. There might still be an erosion, however, much greater than vitrified pipe or brick. The use of wood, both treated and untreated, has been more or less common. Creosoted stave pipe is used in New York and Brooklyn for outlets. A stave pipe 7 feet 2 inches in diameter and 8 inches thick was built in Boston in 1882, and, although not treated, was sound in 1902. Another similar one in the same city 10 feet 6 inches in diameter was lined with four inches of brick.

"Silicate" sewers of sand and sulphur and other pipes of other materials have been tried from time to time, but none have proved successful, and most were very expensive.

Joints are the weak points in all sewers, and the less there are the better, speaking generally, for which reason three feet length of sewer pipe are better than two feet. By far the largest proportion of sewers in this country carrying house sewage only is of vitrified pipe with cement joints, and it is of importance to consider whether such can be made impervious. The evidence would seem to indicate that this is impossible. Even joints made in the laboratory with the greatest care permit appreciable infiltration. But with careful, conscientious work such joints can be made, the writer believes, which will not permit an infiltration exceeding 1,000 gallons per mile per day for each inch of diameter of pipe and each two or three feet head of ground water above the same.

Tighter joints are made in Washington, D. C., and in some other cities, by bed-

ding the sewer pipe in concrete and carrying a band of concrete up over the joints. The writer had made practically tight joints by filling the "bell hole" in the bottom of the trench with concrete and carrying a band of the same up over the pipe. Both of these methods, of course, add considerably to the cost.

The common cause of leaky joints is the sliding of the mortar out of the joint after it is made, either because originally too wet or because softened by water in the trench. This is prevented by filling the bell hole with concrete; or some engineers wrap cheese cloth around the joint as soon as it is made to hold the mortar in place, which also prevents the mortar from being knocked out of the joint by falling dirt. Mortar is generally retained in the joint more surely if deep-belled pipes be used, as they always should be, in the writer's opinion.

It seems probable, if not certain, that tighter joints result generally from a mixture of one or two parts of good sand with the cement than from neat cement mortar.

Another common cause of leaky joints is the settlement of the pipes after the joints are made. This is objectionable because of the grade also, and should be prevented in every case by suitable precautions.

There are many patent joints made in England, some of which have been used to a considerable extent, in which the general idea is to pour cement grout into the joint, as in making a lead joint in cast iron pipe. Others, in which a composition material is attached to the outside of the spigot and inside of the bell, and there turned to conical surfaces which are greased and pushed together, fitting tightly. But all of these are expensive and it is thought have never been introduced into this country.

Asphalt has been used for filling joints to a very limited extent in Germany and in this country. It cannot be considered to be permanent in contact with water and is easily soluble in a number of substances found in some sewages.

Mr. Kenneth Allen states that tight joints were made in Atlantic City by use of Rosendale cement kneaded into North Carolina pitch pine tar, the joint space being completely filled with this homogeneous mixture.

About the only materials used to any extent for building sewers in place (aside from riveted steel and wood stave), are brick and stone masonry and concrete, both plain and reinforced with steel rods or wires. To the perviousness of the ordinary brick sewers reference has already been made. But a block brick or stone sewer can be made fairly tight, if of more than one ring, without any great expense. The author's method in wet trenches is to complete the outside ring up to the springing line, leaving out a brick here and there if necessary to permit the ground water to enter the sewer and escape over its invert. As soon as the mortar, which should be of quick setting cement, has set, all openings are filled and this outer ring made water-tight by plugging any leaks with wood splinters, oakum soaked in cement, or some other way. A half-inch layer of rich mortar is then plastered over the inside of this ring and the other rings laid as usual. The arch is carefully plastered with a half-inch of rich mortar troweled down to a dense continuous coating. Such a brick sewer will not be absolutely tight, perhaps, but will be nearly so.

Concrete sewers, if of well-mixed and properly-proportioned material and made continuously, or so bonded that there are no seams through the shell, are practically water-tight. Various methods of making concrete almost if not completely impervious were discussed before the American Society of Civil Engineers recently, but good workmanship and materials intelligently applied are sufficient for all ordinary cases. If the trench is full of springs a concrete sewer may be constructed of two rings, small pipes being built into the outer ring extending through it so that the ground water may enter the sewer until the concrete has hardened, when these pipes are plugged and the inner ring built in this dry cradle.

In general, if mortar be made of 1 cement to 2½ or 3 sand, and concrete of 1, 2½, 4 or 1, 3, 5, and if care be taken that all parts of the masonry are absolutely filled with either mortar or stone or brick until set, and that no seam or joint extends continuously more than half way through the shell, such masonry will generally be reasonably tight, much more so than the cases cited above.

# REPORT OF COMMITTEE ON PARK IMPROVEMENTS AND MAINTENANCE.

*By G. A. Parker, Hartford, Conn.*

When I realize that forty-five of the largest cities in the United States and Canada are united in this association, by their officers who have charge of the doing of things, and that the municipal work of fourteen million people is here represented, I wish some one worthy of the occasion might make this report and so bring before you the value of parks and the method of their successful management. I have been met so often with a feeling that parks are a sort of a side show in municipal life, very nice, pretty and pleasant, but not essential, even if desirable, yet may be accepted if obtained without too much trouble; that cities have in the past and can in the future do without them. But I so thoroughly believe they are an absolute necessity to municipal health and the growth of children into strong manhood and womanhood that I would that I could impress that feeling into the very heart of every member of this association, where I am sure it would bring forth fruit a hundred fold, for you occupy positions where all the fruit you can bear will be used by the people you serve. Although park work is often put to one side as the least of the city functions, nevertheless it is assuming large proportions, for counting nothing under one acre, the cities represented here today have 536 parks, containing 41,511 acres, costing last year over $6,000,000 for their care and improvement, an average of less than forty-three cents per capita per year, less than one cent per week per person. There is no function of the cities' work of such vital importance on which such a small sum is expended. It ought to be doubled.

The tendency of the last year has been in two directions: First, a decided and popular movement toward multiplying the number of playgrounds and small parks, the need of which has at last been recognized; second, the inauguration of a complete system of parks, connecting them with parkways, considering the city and its suburbs as a unit and developing that unit by a well thought-out plan. The first of these movements began about five years ago, the second began about ten years ago, but the work along these lines does not attract so much public attention, yet it is fully as important. The larger cities are taking up with all seriousness the playgrounds question, and New York, Chicago and Boston are making rapid progress. Others are preparing to follow. In the work of developing the city as a whole, Washington, Ottawa, Chicago, Providence, Seattle and San Francisco are giving much attention, either by the appointment of commission, the employment of experts and discussion in the press. Several other cities have got as far as the newspaper stage. I leave Boston out of this list, for she is rapidly perfecting her plan and has much of her work so far completed, that she stands in a class by herself. Although New York is doing a wonderfully good work in her playgrounds and public baths, in addition to her general park work, yet she seems to be neglecting entirely the development of her territory as a unit, and it is a pity that she is, for she has opportunities in land and water, in her hills and shore which are not excelled by any city in America. In saying this I do not forget her work in the Bronx or the extension of Riverside drive and the other work she is doing and doing well. The thought I want to convey is that New York has not yet taken serious thought of how her 200,000 acres are to be divided into private and public grounds and how her public grounds are to be subdivided into streets, parkways, large parks, small parks, playgrounds, sites for public buildings and other public purposes. Of course, she is doing an immense amount of all this work, but she does it locally by sections and not as a whole. It is a tremendous proposition to take this matter up seriously as a unit, but we expect tremendous things of New York and we know that whenever she does do it she will do it in such a way that every other city will find the path cut out when it comes to solve a similar problem.

Your committee during the last year did not lose sight of the fact that an annual report would be expected of them at this time, and such information as came their way was jotted down that it might

be used. On Sept. 28 they sent out a list of ten questions to each member of the association as given in the last annual report and we are pleased to say that the response to our letter has been very general and the information received quite satisfactory. From these replies we have been able to get the names and areas of the parks and squares of thirty-eight cities represented in this association and to report that the improvements made in the five hundred and thirty-six parks containing forty-one thousand five hundred and eleven acres have been on a whole quite general and of more importance

G. A. Parker,
Sup't Keney Park, Hartford, Conn.

than usual. Only a comparative small percentage of the total park area is maintained in first-class condition, that is with short grass, the walks and roads kept up and the trees and plantings in good order. In the heart of the city the parks and squares are almost always lighted, the cost being usually paid out of park funds, although not always. In most of the cities the parks are policed by regular city police, the tendency seeming to be in favor of this method. A few, however, are policed by special policemen and there are those who advocate this method very strongly, urging that the man who is an ideal policeman for general purposes is not suitable for a park policeman, for what is required of him in parks is very different than the requirements of the street. The policeman as a rule limits his interest to those who have actually committed an offense. With the park policeman their duty is more to prevent disagreeable actions and disturbances to visitors. They are there more as guides than to arrest criminals and it would seem as if the park interest was better served with policemen selected who are adapted to the greater needs of the park, which certainly many of the city police are not.

There seems to be an ever increasing call for the introduction of features and apparatus for the entertainment of the people. Some of the letters referred to the fact that the amusement parks of the street railroad companies are decreasing the attendance to the municipal parks and one goes so far as to say that when the street railroad parks are opened the city parks are nearly deserted, but when they are closed the city parks have a goodly attendance of visitors.

During the last few months we have indulged our weakness for census work by making a canvass of the railroad parks throughout the United States. We find there are over four hundred of them, nine-tenths of which have been opened within the last five years, and their numbers are rapidly increasing. The work done in their development often is of the most superficial order with little thorough work. The artistic sense is often shocked and they are usually cheap in every sense of the word, yet, they attract thousands of people and are increasing. They have many visitors and in some cities are used by the people to a much greater extent than the city parks. Now, it seems a reasonable conclusion to suppose that this is because they satisfy the needs of the people as the higher, better grade and more artistic parks do not. There is not time to go into this discussion as fully as I would like but I do not believe the reason to be from a lack of artistic instinct or training in the people. They appreciate the higher art and believe in it, but they are hungry for that which gives variety to the monotony of their daily lives. The introduction of machinery in manufacturing life, and the monotony of the laborer's life tend to atrophy in a large number of people who live in cities. To escape this fate they must have variety and change, which they seek greedily, and the higher, better more artistic scenic park is left to those who are weary from variety and not from mo-

notony. Now, what is it that the people find at the railroad parks and which is wanting in the highly developed scenic parks? I will summarize it all by saying that the people, the working people, the common people whom Abe Lincoln said the Lord must love for He had many so many of them, when they go out for recreation they are hungry for something to do or something doing. To those whose work is monotonous, that is, doing the same thing over and over again day after day, activity is absolutely necessary to bring a change into the workings of their brains. Their minds become, as it were, leathery and difficult to receive impressions and only action will impress them. The quiet, restful naturalistic parks make but little impression on their feelings and they take greater pleasure in having their feelings stirred, even though coarsely, than not to have them stirred at all.

The city parks have something to learn in all this and so supply the needs of its poeple. I would not lessen one whit the beautiful naturalistic parks, but I would find some nook or corner ample in area and convenient to the people where those who desire the activities of the railroad parks can have them in abundance. This also would be well for the railroads themselves, as they would receive as much income from travel and not have the trouble of maintaining the parks. Would the people care for this change? There are indications that they would not, unless the park commissioners would enter seriously into the consideration of this factor of the parks work and furnish the variety needed. Commissioner Young of Brooklyn wanted to convert Coney Island into a seashore park, but he was met with a strong demonstration of the people who preferred the present life and activity, the gew-gaws and frivolities and excitements of its present conditions, to the rules and regulations of the park commissioners. All too often have the rules and regulations of the park commissioners been considered in the light of what was good for the park itself and not what was good for the people who visited the parks. There is a problem here which requires a large study, the solution of which does not seem as yet to be in sight.

The new work planned for by the cities of this continent is very great. The last few years have been so prosperous that the cities have ventured and are venturing upon expenses which ten years ago would not have been considered. New York is planning to spend several million dollars on its small parks and playgrounds. The Metropolitan Park commission has been authorized to expend $3,000,000 for the addition and improvements of their territory, covering a term of years. Cincinnati has $1,000,000 to spend for additional parks, and the different park boards of Chicago have from $1,000,000 to $1,500,000 each to spend for parks and playgrounds. San Francisco last month voted over a million for increasing its parks and playgrounds, and the park question in the smaller cities is making great headway. Fully $10,000,000 has been voted for increasing the park work during the next few years.

We would like to call your attention to results accomplished by separate cities, and would mention first New York City, for there we find the greatest improvement. And also because what is done or not done there affects more people and has greater influence throughout the country than any where else, besides they are forced by circumstances to solve many problems in advance of other American cities.

New York has roused herself and has gone forward during the last year with her park work at a rate unsurpassed by any city at any time. She has constructed a forty-acre park in as many days, which illustrates the vigor of her work, and every one of her eighty odd parks has received increased attention and a better degree of maintenance, and many of them have been so greatly advanced in their improvements that their completion seems in sight, and when it is realized that all this gain has taken place with largely the same employes that have worked in the parks for years and that the gain has been altogether greater than the additional expense, one will realize that it has come about by a more masterful hand and a stronger energizing spirit that has given a quickening element to all persons connected with them. This is the great lesson that New York has for us this year that park work cannot rise above the capacity of the administration, and that it will always respond to meet whatever is expected of it from those in authority. We all admire Col. Waring's administration in the street department; we can now as justly give our admiration to Messrs. Willcox, Eustis and Young, the park commissioners of New York City.

New York's work this last year will place her nearly, if not quite, at the head of the list in park development and

maintenance, while three years ago her average rank was in the twenties. To those who believe in parks and playgrounds, that they are for the people, I do not know of any event during the last year in the park world which will give greater satisfaction than the advancement of New York City during the year since our last meeting.

I desire especially to call your attention to Washington. Three years ago the McMillan Park commission, so called, was appointed. This commission consisted of the best men this country afforded.

In its personnel there were Burnham of Chicago, Olmstead of Boston, McKim of McKim, Mead & White of New York and St. Gaudens. They studied the problem very carefully for two years and presented a report with tentative plans that I believe have met with universal praise from the people and the press. Last year Congress took this matter up and without discussing the worthiness or the unworthiness of the work of the commission, or anything connected with what Washington should be, killed the whole matter in committee because this commission has spent $48,000 in their preparatory work. Now, Washington depends upon the action of Congress and Congress is made up of men whom you and I vote for. So thoroughly do I believe in the need of a well directed and continuous effort for the development of Washington in the fulfillment of the plans suggested, which are in harmony with the original plan of L'Enfant and Washington, that I am going to ask this association at this time to pass the following resolution:

"Resolved, That the American Society of Municipal Improvement is in hearty accord with the plans and suggestions for the development of Washington of the commission appointed by Chairman McMillan of the District of Columbia committee, commonly known as the park commissioners, or of some similar plans in harmony with the original plan of L'Enfant and President Washington. And, that our purpose and influence may be known and exerted in all legitimate ways, that a committee of five shall be appointed by the incoming president, of which he shall be one, to have full power to represent our society in this matter and report at our next meeting."

The resolution was unanimously adopted by the convention.

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## THE PARK SYSTEM OF INDIANAPOLIS.

*By George Merritt, Park Commissioner.*

In this little talk about the parks of Indianapolis I shall not try to convince you that we have the best system of parks in the country or the most beautiful scenery in them, but we have a fair share of beauty and a good system that is steadily adding new beauties, all of which speak for themselves. I think it better to study our mistakes.

The park history of Indianapolis is only 36 years old, and for the first 33 years the development was very slow because those that were appointed to care for them were usually appointed for political reasons, and were changed so frequently with the changing administrations that they could not be expected to do much efficient work for the parks and attend to the needs of the political machine of which they were a part.

In 1867 work was begun on the Military reservation to improve it. One thousand five hundred dollars was raised by private subscription from citizens living in the neighborhood and $1,000 was appropriated by the city. This sum of $2,500 was expended by the citizens who had contributed to the fund, and with careful management was sufficient to grade the surface of the park, to lay out and grade the drives and walks, purchase and plant 1,000 native forest trees and to furnish the central pool with its rockery, to provide a very small fountain and to seed the grounds with blue grass. For six or seven years the care of the park remained in the hands of those who had contributed to the fund for its improvement, and the enthusiasm that had prompted the first steps in the improvement was sufficiently continuous to insure proper care of the park and a healthy growth of a love for its beauties, even the children taking an active interest in its development and care, and during that period it was an ideal spot for the children, and thousands of the little folk enjoyed it. But as time passed circumstances deprived the park of the care of those who had so suc-

cessfully developed it, and its care was left entirely in the hands of a custodian appointed by the council, as dictated by alternating political parties, with the usual result that the physical care of the park was neglected, allowing it to become shabby in appearance, while its moral atmosphere became so corrupt that decent people shunned it and parents felt compelled to keep their children away.

About 1873 the city council bought the 97 acres known as Garfield Park, paying for it $109,500. From 1875 to 1894 Garfield Park was little more than a political foot ball, used alternately by each political party to pay its campaign debts, one party hauling in dirt to fill in the low ground along Pleasant Run and the other digging it out again to make a lake; thus doing and undoing because there was no head or system. This continued until 1895 when the non-partisan Board of Park Commissioners, created by the legislature, took charge of Garfield and began a system of improvement that has gone steadily forward ever since that time, giving the city a beautiful park.

In 1895 the Board of Park Commissioners began the plans for a comprehensive system of parks and boulevards, extending from Washington-st. along the east side of White River to the mouth of Fall Creek, thence northwardly, taking in both banks of Fall Creek up to the State Fair Grounds. This tract had many owners and was largely used as a dumping ground for the trash and street sweepings of the city (which seems to be the common use of banks of streams in all cities). If that tract of land had been secured it would have converted ugliness into beauty, unhealthfulness into healthful pleasure. The ground is easily accessible to all the city, but only a small portion of the many owners of this tract met the Board in a spirit of fairness as to the value of their ground, while some seemed to feel it was a favorable opportunity to force the city to pay them a large price for property hitherto considered of little value. This spirit so enhanced the price of this tract that the amount to be assessed on adjoining property as benefits was so large that it aroused an opposition to the scheme which finally took it into the courts, where the law creating the Board of Park Commissioners was declared unconstitutional on a verbal technicality. The abandonment of this tract was a very serious mistake that can never be wholly corrected.

The Board of Park Commissioners having been courted out of existence, the work of securing ground for a large park was taken up by the Board of Public Works with the result that Riverside and Brookside Parks were bought. Both of these tracts have elements of beauty that make them well fitted for parks but they are too far from the people, and to reach them one must pass through or near the unsightly dumps of trash before referred to. Time, however, will bring the city to those parks, and tweno occupied and the objectionable accumulations entirely removed or destroyed. The Board of Park Commissioners stands ready to assist in that good work whenever they are given a chance and have the support of the public.

In the movement for boulevards along Fall Creek and Pleasant Run an opportunity is offered to eliminate many of these unsightly places and out of ugliness bring beauty, but the appropriation made by the Council is so inadequate that unless the citizens of that part of the city supplement the sum by large liberality, only a beginning can be made. I am very pleased to know that some of these citizens have already shown their appreciation of the importance of these boulevards by making liberal donations, and if all who will be benefited will show the same liberal spirit much good will be accomplished. This movement should be extended until the banks of all streams inside the city are controlled by the Board of Park Commissioners and boulevards constructed to all the large parks.

In 1900 the Legislature re-enacted the law creating a bi-partisan Board of Park Commissioners, and since this Board was organized the work of park improvement under the supervision of our competent superintendent, J. Clyde Power, has gone steadily forward, each year adding new beauties to our many parks.

My experience and observations demonstrate the importance of a comprehensive law under which a bi-partisan board shall manage the parks on strictly business principles; a board that will allow neither political or personal reasons to control in selecting men to fill any positions in connection with park work, fitness for the work being the sole consideration; having secured good men few changes should be made in any part of the work; even common laborers are more efficient after

they have had experience and should not be changed except for cause; a board that will work in harmony with other departments of the city government, particularly the police department, as efficient policing is very important; in this respect we have been very fortunate.

The woman is another very important factor in park life; wherever children are there should be a good and competent woman to care for them and assist them in their play. One such woman can do more to preserve a pure moral tone in the parks than any other available force and unless it is maintained the fewer parks we have the better.

Politics having been eliminated, we are now making rapid strides to have parks in keeping with our beautiful city.

The Board of Park Commissioners and the Superintendent fully recognize the fact that the parks should be for recreation. A number of pictures were shown of beautiful spots in the parks, the uses made of them and the buildings in them. Some of these illustrations are reproduced herewith and with their titles explain themselves.

## REPORT OF COMMITTEE ON ELECTRIC STREET LIGHTING.

*By E. A. Fisher, Rochester, N. Y.*

With reference to the cost of lighting, your committee presents no detailed tables of prices paid for arc lights in American cities. The usual contract period for arc lighting is five years. Tables of cost were given in our own reports for the years 1897 and 1902. We have made general comparisons of the cost in eight representative states. For the purpose of comparison, 2,000 candle power is estimated at 450 watts.

In general, it may be said that there has been a gradual reduction in price paid per lamp per year for arc lighting, and a very marked increase in the amount of light furnished for a given sum. Statistics giving averages of cost under such extreme variations in local conditions as exist can be made use of only in a very general way in any particular locality.

Many of the otherwise beautiful streets of our cities are still disfigured by an unnecessary number of unsightly poles and overhead wires. The street lamps, lamp posts and attachments are also in many cases in perfect harmony with their unsightly surroundings. There is no branch of municipal work where the protests of indignant citizens are so numerous and violent as against the continuance of these unsatisfactory conditions. Your committee is especially fortunate in having presented to this convention a demonstration from the manufacturers of electric lamps and appliances, that the most efficient up-to-date lamps are also the most ornamental. It is further a source of gratification that such lamps and fixtures are rapidly superseding the former less handsome ones.

Complete records of the existing conditions are also an essential to any improvement. The paper by Mr. Hatch gives the practice in the second largest municipal electric light plant in this country, and the one most referred to as a model for plants.

The question of municipal ownership of electric street lighting plants has been prominently before the public during the year. General statistics of the operations of these plants are of little value as a guide in determining the advisability of establishing such a plant in any

| STATE | Average Hours Per Year. | | Contract Price Per Lamp Per Year. | | Cost Per Lamp Hour. | | Watts Per 1 cent. | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Open Enc. | |
| | 1897 | 1902 | 1897 | 1892 | 1897 | 1902 | 1897 | 1902 | |
| California | 2,887 | 2,365 | $119 63 | $94 50 | $.045 | $.042 | 103 | 102 | 144 |
| Colorado | 3,387 | 2,904 | 130 67 | 95 68 | .043 | .036 | 123 | 150 | 110 |
| Illinois | 2,668 | 2,291 | 76 74 | 67 57 | .031 | .034 | 137 | 140 | 183 |
| Indiana | 2,590 | 2,483 | 81 39 | 66 72 | .035 | .026 | 132 | 178 | 175 |
| Massachusetts | 2,563 | 2,596 | 79 12 | 85 86 | .037 | .039 | 87 | 120 | 109 |
| New York | 3,230 | 3,030 | 81 96 | 75 90 | .026 | .028 | 140 | 170 | 189 |
| Ohio | 3,413 | 4,049 | 79 56 | 38 92 | .025 | .014 | 177 | 184 | 200 |
| Pennsylvania | 3,925 | 3,704 | 86 14 | 60 59 | .022 | .018 | 196 | 241 | 277 |

given locality. We believe great advances will be made in the efficiency of street lighting in the near future. One result of these betterments will be to render useless much of the present electric machinery. It may be well to consider whether some system of regulating rates, similar to that in vogue in the city of Boston, where the price charged is subject to revision at stated periods by arbitration, will not for the present offer in many cases advantages over municipally-owned and operated plants. The report of the fifth annual convention of this society contains a complete description of the Boston contract.

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## STREET LIGHTING IN ROCHESTER, N. Y.

*By E. A. Fisher, City Engineer.*

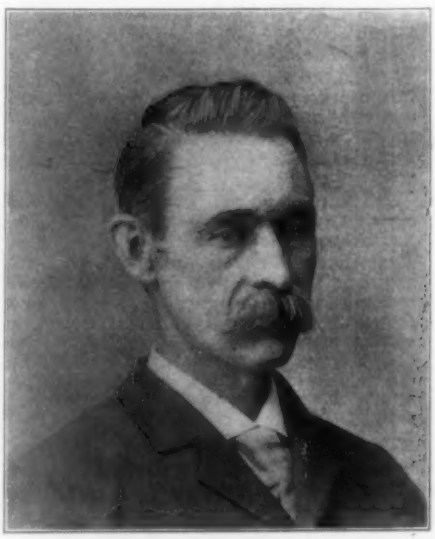
The city has a total area of 11,365 acres, or 18.18 square miles. In this area are about 320 miles of streets and alleys. On January 1, 1903, the city was lighted by 2,804 electric arc lamps and 141 gas lamps. Omitting the gas lamps, the city had an average of one electric lamp for 3.68 acres, and an average of 8¾ lamps per mile for the entire area. A portion of the city is not yet built up and has no street lights, therefore the average number of lamps per acre, and per mile, for the portion lighted is somewhat larger. Going a little further into detail, it should be stated that a portion of the business district is lighted by the double arc light system, two lamps on one pole. The lamps are of the enclosed type, operated in parallel on a 115 volt current. The larger part of these lamps are operated on the direct current. The poles are of iron and serve also as trolley poles for the electric railway. The railway poles are generally 125 feet apart. This condition was a controlling factor in locating the lamps.

On Main-st. the two principal street crossings have four double arc lamps, one on each corner. At the other street crossings two double lamps are placed. In a distance of 6,400 feet there are sixty-one pairs, or 122 lamps—an average of one pair of lamps per 105 feet of street. This street is probably the most brilliantly lighted street in the world.

This double system is in use on eight miles of streets. In this distance there are now 240 pairs of lamps, or an average of thirty pairs per mile. The average distance apart is 188 feet.

These lamps are what are known as 1,200 candle power, and are specified to operate on not less than five amperes of current with seventy-two to eighty volts requiring not less than 360 watts at the arc for direct current lamps, and five and one-half amperes with seventy-two to eighty volts requiring not less than 360 true watts for the alternating current.

A portion of these lamps are placed at street intersections. The length of street lighted is about 50 per cent. more than the length of street on which they are placed. The total length of street lighted is therefore about twelve miles.



E. A. Fisher,
City Engineer, Rochester, N. Y.

The 480 lamps cost $68.61 each per year, or a total of $31,972.80 for twelve miles of streets, or $2,664.40 per mile of street. The wires in this district are underground.

The other portion of the city is lighted generally by single arc lamps attached to poles operated on the direct current series system. At the present time they are mostly open arcs of nine and one-half to ten amperes, and forty-five to fifty volts at lamp terminals. The con-

tract provides that all open arc lamps shall be changed to the enclosed, within five years. The specifications require an alternating current of 7.5 amperes, seventy-two to eighty volts at arc requiring 450 true watts energy at arc. The company has begun to make the change and is now operating fifty-three of the 7.5 ampere lamps. A few enclosed arcs are also operated on the ten ampere direct current. The average distance apart is 360 feet. As many of these lamps are located at street intersections the average distance of street lighted is about 50 per cent. more, or about 540 feet; an average of about ten lamps per mile. These lamps cost $78.50 per year. The cost therefore is about $785 per mile of street. The wires in a large portion of this district are overhead.

Recent current measurements taken with the ammeter, the volt-meter and the watt-meter in connection with luminometer measurements, show the following results:

Series direct current open arcs average 9.8 amperes, 50.5 volts, 490 watts, 151 to 180 feet luminometer distance.

Series alternating current enclosed arcs, 7.50 amperes, 64 to 74 volts, 500 to 560 apparent watts, 400 to 450 true watts, 120 to 165 feet luminometer distance.

The above are known as 2,000 candle power lamps.

Constant potential direct current enclosed arcs, 5 amperes, 74 volts, 360 watts, luminometer distance 121 to 156 feet.

Alternating current enclosed arcs, 5.5 amperes, 80 volts, 440 apparent watts, 374 true watts, luminometer distance 120 to 153 feet. These lamps are known as 1,200 candle power lamps. The luminometer distance was shortened in some cases by dirty globes. A clean opal inner globe, and a clear outer globe, gives the best effect.

The outages of lamps are reported daily by the police, on blanks prepared for the purpose. They also notify the lighting company by telephone. The company maintains a night patrol of three or four wagons, with two men to each wagon. The outage reports for seven months of 1903, ending September 1, have been analyzed with the following result:

Open arcs 2,190. Total number reported out in seven months, 243 nights, over one-half hour, 2,106; an average per night of 8.67 lamps, or 41-100 of 1 per cent.

Enclosed arcs 614. Total outages for same time, 120; an average of 0.50 lamp per night, or 8-100 of 1 per cent.

Boston reported for 1898, 2,893 lamps, mostly open arcs; 85-100 of 1 per cent. outage, and for 1898, 3,024 lamps, mostly enclosed arcs, 27-100 of 1 per cent. outage.

Detroit, for 1900, 2,035 lamps; 11-100 of 1 per cent outage.

St. Louis, for 1902, 953 lamps; 106-100 of 1 per cent outage.

The following table showing comparative cost per capita and per acre for lighting in eight American cities was compiled from the United States Census Bulletin of Labor for September, 1900.

| City. | Cost Per Capita. | Cost Per Acre. (Total Acreage.) | Cost per Mile of Streets. (Total Mileage.) |
|---|---|---|---|
| Providence, R. I. | $1 72 | $25 85 | $1,310 00 |
| Rochester, N. Y.— | | | |
| 1899 | 1 44 | | |
| 1900 | 1 52 | | |
| 1903 | 1 30 | 19 00 | 700 00 |
| Boston, Mass. | 1 21 | 11 20 | |
| Cincinnati, O. | 1 05 | 16 43 | |
| Buffalo, N. Y. | 97 | 13 51 | 530 00 |
| Philadelphia, Pa. | 85 | 13 40 | 754 00 |
| Indianapolis, Ind. | 67 | 6 34 | |
| Columbus, O. | 60 | 7 18 | |

In view of the comparatively low price paid for electric lights and the high per capita cost and high cost per acre, exceeded only by Providence, R. I., and Yonkers, N. Y., the speaker believes that Rochester can justly claim to be one of the best lighted cities in this country.

# THE CENTRAL HEATING PLANTS OF INDIANAPOLIS.

*By W. K. Eldridge, Civil Engineer.*

Central station heating plants are so rapidly growing in popularity that they cannot be installed fast enough to keep pace with the demand. Particularly is this true in central and eastern Indiana, where the conveniences of heating by natural gas have instilled in the people a strong aversion to a return to coal handling and firing for their stores, offices and dwellings, fast being forced upon them by the failure of the gas fields. In conjunction with the production of light and power (the exhaust steam from which was in former times largely allowed to go to waste), a revenue is derived from this erstwhile waste product from rates easily within the reach of consumers in even moderate circumstances. It is not strange then that central station heating should be a most attractive consideration to both producers and consumers; and in the case of municipal electric light works, might often transform a taxing proposition into a self-supporting one. Such plants are beginning to have a great vogue in the smaller cities of the state, the writer and his partner (but one firm among many) having been connected with the installation of systems in Newcastle, Peru, Connersville, Terre Haute, Ft. Wayne, Lafayette and Bloomington, Ind., Mt. Vernon, Ill., and Springfield, Ohio, within the space of a single year. All these plants are operated in conjunction with electric lighting, and in two cases the production of artificial gas, also.

Indianapolis was early in the field with a company named the "Home Heating and Lighting Company, which in the year 1899, obtained a franchise from the city for an area of about two and three-quarter square miles on the north part of the city surrounding the location of their works, on the corner of Alabama and Sixteenth-sts. This plant is designed to furnish hot water and electric light, with wires on poles, and now has about nine miles of double piping and thirteen miles of pole line. The total radiation in service is now about 325,000 sq. ft., taxing the plant to its fullest capacity in the severest weather, so that large additions are being considered. The boiler capacity is 1,800 rated H. P., and the lighting capacity 250 K. W., furnishing electric current at 2,250 volts alternating. The service is almost wholly residential, the water being heated by the exhaust steam, reinforced with live steam automatically whenever necessary, and is circulated through the mains and radiators by means of powerful pumps. This plant is the largest for hot water heating yet installed in the United States.

The Marion Company is now breaking ground for the foundations of its power house, to be furnished next year with complete electric lighting and hot water equipment.

As exemplifying how factories and other enterprises producing power may thus utilize their waste steam for revenue, the writer will instance the Century Building, corner of Pennsylvania and Maryland-sts. (John W. and Edward Schmidt, owners), with the erection of which the writer had the honor of being connected. This building is seven stories and basement, covers an area of 135x195 feet, affording a net rentable area on each floor of about 20,000 sq. ft. On each floor are from two to a dozen tenants engaged in manufacturing, and furnished with heat, light, water and power from a steam plant in the basement. The latter consists of two Stirling boilers of 200 H. P. each, to which is now being added one more of 250 H. P., two engine-dynamos of 50 K. W. and 80 K. W. respectively, to which is now being added a new Corless of almost 200 K. W. capacity. The heating system of the building is by exhaust steam with vacuum return; and is being found that much more steam was required for power than necessary to perform the heating service, steam pipes were run in several directions to many of the neighboring buildings, including a four-story office building, covering 14,000 sq. ft. of ground, abolishing at least a dozen smoky chimneys in the heart of our business district, about which there had been much complaint. This last feature is not one of the least advantages connected with a central heating system.

One of our citizens who has a large rental property in the north part of the city, put in a central heating station for his cluster of houses, and has applied for a franchise enabling him also to take on the neighboring houses in the same square.

The most important enterprise of this

nature in the city is the new Merchants' Heat and Light Company, which has seen one winter of service. Their franchise covers the so-called original mile square of the city, of which the exact center is the Soldiers' Monument in the Circle, and gives them access to the main wholesale and retail centers, public buildings and other business territory. The writer and partner have the honor of being also connected with the installation of this enterprise. The power house is located in S. New Jersey-st., one-half square south from Washington-st., from which is distributed electric light and

W. K. Eldridge, C. E.,
Indianapolis, Ind.

power and direct steam heat on a single pipe system. The building comprises an engine room 30x90 feet, with basement for heaters, condensers, piping, etc., and a boiler room 45x90 feet, and is so located on the ground that the capacity of each room may be doubled by future extensions. In the boiler room is installed a battery of seven Wickes upright water-tubular boilers with Roney stokers, giving an aggregate of 1,750 H. P., working up to 2,100 H. P. The future addition to the boiler room will afford space for seven more boilers of the same type, facing the present battery, and it is the intention at that time to install overhead storage bins between the two batteries for the coal, with spouts leading to the hoppers of the stokers. A railroad siding runs along the south side of the building. A tunnel under the ash pits (not yet in use), is intended to provide space for ash handling machinery in the future.

The products of combustion are discharged on the down-draft principle into a smoke duct 6x9 feet in area, running along the floor back of the boilers, and turning into a smoke tunnel along the north wall of the room, and running underground through the backyard to the stack, which is circular, 9 feet in diameter and 165 feet high from the ground, built of hollow radial blocks. Adjoining the stack is a cooling tower for the condenser water 13 feet diameter and 32 feet high. In the engine room are four engine-dynamos of 1,200 K. W. total capacity, furnishing electric current at 230 volts, three-wire system.

The street system consists of the steam mains, electric wire conduits and a compressed air pipe.

The principal steam main leaves the house 20 inches in diameter and runs west in Washington-st. for about 2,800 feet to the first reduction. Altogether about 16,000 feet of steam piping and 150,000 feet of conduit have been laid to this date, and the work still goes on. The total radiation expected to be supplied this winter amounts to 175,000 sq. ft.

Expansion joints, accessible from manholes, are placed in the steam mains about 150 feet apart, with anchorages midway; all steam mains are enclosed in several thicknesses of insulation and boxed in. A compressed air pipe three inches in diameter is run in the same trench, the compressed air being for the purpose of operating the shut-off valves in the various buildings supplied. In each building are placed one or more thermostats, by the action of which the compressed air is admitted to or released from the shut-off valves. Not only is the temperature of the building thus regulated, but a material saving of steam is effected.

The water of condensation in the various buildings is utilized in boxed coils in the basement for indirect radiation, the warmed air passing through registers in the floor above. By this means several desirable results are obtained. The room heated derives the benefit of a certain amount of fresh, warmed air, in addition to the direct steam heat, and an equivalent amount of steam is saved; the net result to the company being more economical than if the water were returned to the station, which would re-

quire quite a complicated system of piping, vacuum pumps, etc., with added risk of getting out of order. Wherever it is desired, the hot water is further used as water, as in hotels, etc., with addition to revenue; otherwise runs off into the sewers. Low points in the street mains are trapped into the sewers.

In the same trench, to one side of and a little above the steam main boxing, are laid the electric wire conduits, leaving the power house twenty in number, of which fifteen are at present occupied with cables of a total capacity of 5,300 amperes at 115 volts pressure. The construction and means of access are much after the usual style for such work.

Nearly all the trenching has been cut in sheet asphalt; and the restoration of the street surface will doubtless be of interest to many of the members of this convention.

The incorporators of this project are many among the most solid and prosperous merchants of the city, the first idea having been almost of a co-operative nature for their own relief and service, but soon extended to its present magnitude. A sincere attempt has been made by the builder, Mr. William H. Schott, to have the entire outfit up-to-date in every particular, and the whole has been installed in a very creditable and efficient manner to the unqualified satisfaction of the company.

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## THE INDIANAPOLIS WATER COMPANY.

*By F. A. W. Davis, Vice-President and General Manager.*

On Jan. 27, 1836, the Legislature of this State passed an internal improvement act. Section 4 of this act provided for the construction of the Indiana Central Canal. Appropriation of $3,500,000 was made. The canal from the City of Indianapolis to Broad Ripple was constructed and put in use in the year 1839. Jan. 30, 1851, the canal was sold to Gould and Jackson, who conveyed the same to the Manufacturing Hydraulic Water Works Company. May 1, 1870, the canal was transferred to the Water Works Company of Indianapolis. April 21, 1881, the Water Works Company, including the canal, was conveyed to Hamilton, Woodruff and Dennison, who conveyed the same to the present Indianapolis Water Company. At the time of the transfer the Indianapolis Water Company had about 52 miles of mains and about 9,000,000 gallons in 24 hours pumping capacity. The present works consist of a little over 250 miles of mains and 1,990 hydrants. Present pumping capacity 57,000,000 gallons in 24 hours, and under construction by the Rarig Engineering Company, from plans furnished by L. K. Davis, one 30,000,000-gallon triple expansion high duty engine. Attachments in service, 14,250. The increase in the twenty-two years is nearly 200 miles of mains and an increased capacity of pumping machinery of 78,000,000 gallons.

The buildings of the Company consist of four pumping rooms and two boiler rooms. Two of the buildings erected are handsome pumping stations, and surrounding them are 252 acres of ground, which tract is being converted into a park.

The 20,000,000 triple expansion engine has broken the world's record for high duty engines of its class, and is certainly a beautiful piece of machinery.

The engines of the Water Company do not have the advantages that an engine pumping into a reservoir or into a standpipe have in making a record for duty, for the load upon ours is constantly changing.

The canal supplies the Water Company with about 1,000 horsepower for its water power pumps, besides supplying mills and factories located along its banks with water for various purposes.

The growth of the Water Company to many may not seem great, but when it is remembered that there are three veins of water to compete with and the supply in the beginning of the Water Works Company was not satisfactory, the growth will appear to be quite remarkable.

To get a cool drink of wholesome water from a well and not be dependent upon a corporation, either city or private, was much to the liking of many. At one time in our history the State of Indiana had the fewest water works to the number of inhabitants of any state in the Union except North Carolina.

The waters of the three veins mentioned vary in character somewhat. The first vein, from 18 to 40 feet in depth, having no iron; the next vein, passing through a layer of blue clay at a depth from 60 to 90 feet, showing trace of iron; the third vein, if it may be so termed, found in rock strata being quite highly impregnated with iron and having a distinct odor of sulphur.

The water at the present time is obtained from 30 wells, 25 being 10 inches and five eight inches in diameter. They are of an average depth of 320 feet. Two of the wells were drilled to a depth of 510 feet, but they showed no increase of head and a decided increase of sulphur. The water, when brought up from the wells, is very beautiful, but in a few hours the iron begins to precipitate and gives the water a milky appearance. After the iron has been precipitated the water becomes bright and clear again, and there is a brown powder left on the bottom of the bottle. The wells are on an average about 220 feet in rock, the drill sometimes striking seams between layers of rock as much as 18 inches. Only in one well did the drill show a perpendicular opening in the rock. The chemical analysis shows other variations in the water than that mentioned. However, both analysis and bacterial examination of the water show it to be high class. Three veins showed the water to be good at one time, but all hard water. The growth of the city and the digging of cesspools in the gravelly soil has contaminated very many of the first and second vein wells and the quantity of water in all well supply is growing less. When our first well was drilled it overflowed the water in the river with an eight-foot head and was a beautiful sight, but at present the water stands 33 feet below the eight-foot head. The water from the wells is lifted by air, a very expensive and wasteful method and not recommended. The temperature of the air produced by the compression increases its volume, and when the air comes in contact with the water the volume is reduced and the lifting power of the air is reduced accordingly.

The Company received its authority by legislative act of 1865, which authorized it to construct water works and to make charges, rates, rules and regulations for the government of the Company.

The flat rates of the Water Company are among the lowest in the country, being $3.00 per annum for a two-room house, $4.00 for three rooms, $5.00 for a six-room house; $1.00 for each additional room; bath, $3.00; closet, $3.00 per annum. This charge includes laundry tubs, wash stands in all the rooms and kitchen sink.

Sprinkling rates, in connection with family use, are low, depending upon the street. They include water for garden and lawns and washing of windows, porches and sidewalks.

The highest meter rate was originally 40 cents a thousand cubic feet, the lowest 15 cents. It is now 18 cents, the highest, and 4½ cents, the lowest, being a graduated scale of charges and so arranged that though a man may receive more water and pay a less price the Company will receive an additional sum of money. In other words, there is nothing in the scale to encourage anyone to waste the water in order to get low rates.

In this connection I am reminded of one city that has a minimum rate of $6; for the first 30,000 gallons $1.75 and 2¼ cents thereafter per 1,000 gallons. At the rates mentioned a consumer is entitled to 219,000 gallons of water per annum for $6.00, being equivalent to 500 gallons a day, equal to nearly 10 hogsheads of water, and to 5,013 pounds in weight per diem. It may be argued that a man will not use 600 gallons of water a day but that does not alter the proposition that for the payment of $6.00 he is entitled to 219,000 gallons of water per annum.

If consumers drew the quantity of water they are entitled to per diem I question very much the ability of the works to furnish it during certain hours. This rate is a stumbling block to many municipally owned water plants as well as private plants, and it is not what would be termed a sound business proposition. In this connection it is proper for me to say that the value of water is steadily increasing in most parts of the country by reason of the cost of filtration and the scarcity of the supply.

At the present time the Water Company has a contract with the city in which the city agrees to pay $45 per hydrant. In addition to furnishing fire pressure the company furnishes city water free of charge for a fountain in each of the parks; "also water for each engine house, each reel house, each station house, city dispensary, thirty thousand gallons of water at each per month,

if so much shall be required; also water for the police headquarters, four hundred thousand gallons per month, if so much shall be required; also water necessary for the purpose of flushing and cleaning public sewers and improved streets and the filling of public cisterns within the reach of the line of water pipe. Also water for Tomlinson hall and market houses, five hundred thousand gallons per month, in the aggregate, at said hall and market houses, if so much shall be required. Also water for the city hospital, six hundred thousand gallons per month, if so much shall be required. Also water for public baths, when established, one hundred thousand gallons per day, if so much shall be required. Also water for sprinkling lawns and roadways in all public parks, five million gallons per month, in the aggregate, if so much shall be required. Water from the canal to supply a four-inch pipe for the lily pond in Riverside Park, the pipe for such four-inch line to be furnished, laid and maintained by the city, and the water drawn therethrough for said pond not to be computed as a part of the said five million gallons above mentioned. The members of the fire department may, without cost to the city, use water from the fire hydrants or plugs to sprinkle the streets immediately adjacent to the several engine houses and hose reel houses, provided ordinary sprinkling nozzles are used for that purpose.

The hydrants are put in and maintained by the Company at its expense. The Company furnishes a man, at its own expense, to attend all the fires. He sees that the hydrants are properly opened and also sees that they are put in repair promptly if broken. The city has no responsibility for any accident that may occur to him in going to and from, or in attending, fires.

The Company pays of its gross receipts a fraction over 8 per cent. for taxes, so that out of every hundred dollars received $8 is paid for taxes.

The Company takes deep interest in its employees. It requires them to be sober, industrious and temperate. Some of them have been with the Company between twenty and thirty years. Vacation is allowed them during the year, and during sickness their wages are paid them. They are encouraged to learn all that pertains to their own particular position and water works in general. The more intelligent they become the more valuable they are to the Company. They are also encouraged to own their own homes, and the Company has constant anxiety for their welfare and that of their families. This is in contrast with municipal ownership, where men know that they have often received their appointment through political influence, and may be changed when a change in political situation occurs. Under the circumstances they have great anxiety to retain their positions and cannot put forth their best effort and thought for the interest of the Water Department, and often they are found planning, soon after being installed, how they will retain their position. On the other hand, the Water Company plans how it may keep good men. The Water Company never questions a man's politics nor his religion.

The mains laid by the Company are considered by many as being excessive in weight, and manufacturers of machinery have claimed that our specifications for machinery are heavier than required, but it must be borne in mind that we furnish direct pressure for fires (engines being rarely used) and the machinery must be massive and strong.

The cost of a system built for fire protection is greatly in excess of a system built for ordinary domestic supply. Mr. Fanning, an engineer of high authority, estimates that a water works plant of eighty miles, built for domestic use, would cost $333,333, and where built for fire protection and domestic use, with 960 hydrants, would cost $1,000,000; operating and fixed charges $812 per mile greater for combined plant, making $67.70 actual annual cost per hydrant.

The company has now under construction a handsome laboratory and filter beds for slow sand filtration. The bottom of the beds is constructed of concrete, and on top of this are laid tile with perforated tops, through which the water runs to the collecting galleries after percolating through four feet of sand and gravel. The water flows to the clear water basins and from them into the conduit line, thence to receiving well, from which the pumps take water through their suction pipe. The wash gallery is separate from the collecting galleries and is to be used for draining when the beds are first filled with water. The beds are three in number, are 200 feet wide by 350 feet long, with two clear water basins 70 by 350 feet; storage capacity of each clear water basin, 2,500,000 gallons. On account of free drainage, there being 2,000,000 five-eight-inch holes in each bed, and free access of the water to the gal-

leries, we estimate that we will get 5,000,000 gallons of water per acre per day of excellent water. We are confident from the form of construction that our beds will be an improvement over the older form of filtration beds. The work is done by the United States Sand Filtration Company.

## THE CONSTRUCTION OF THE SIXTY-INCH REINFORCED CONDUITS OF NEWARK, N. J.

*By Morris R. Sherrerd, Chief Engineer of Water Department.*

The city of Newark, N. J., has an abundant supply of excellent water derived by gravity from the Pequannock river, one of the tributaries of the Passaic. The watershed embraces 62 square miles, situated in the northerly part of New Jersey, about 25 miles distant from the city.

At least 75 per cent. of this watershed is of a rugged and mountainous nature, the entire territory so sparsely settled and such thorough methods adopted to prevent pollution that the city is justly proud in being able to claim the best gravity water supply in the country, if not in the world.

The water is collected in four large impounding reservoirs, having a combined capacity of nine billion gallons, and is delivered by gravity to the city through two steel conduits, one 48 inches and one 42 inches in diameter. These works were built by the East Jersey Water Company during 1890, 1891 and 1892 and were operated by that company until September, 1900, at which time they were taken over by Newark.

In the city itself there is very little reservoir capacity to furnish a supply of water in case of accident to the watershed conduits and as the two pipes are laid only 12 feet apart for their entire length of 22 miles, anything causing injury to one would be liable to affect the other. Hence, when Newark took the works from the East Jersey Water Company immediate steps were taken to guard against any possible water famine resulting from accidents to these conduits by building a large storage reservoir near the city. The advisability of additional reservoir capacity near the city and the advantage of an independent pipe line were clearly shown by the effect of the recent flood in the Passaic river valley, when the swollen condition of a small trout stream, resulting from a continuous rainfall of 14 inches in thirty-six hours, made a washout under the two conduits now supplying the city, leaving them suspended for a distance of 35 feet. Only the fact that they were composed of steel pipes saved the city from a serious water famine.

The site selected for the new reservoir is a natural basin about one mile from the watershed conduits, and about seven miles from the city, the general route by way of the reservoir being somewhat more direct than by way of the original conduits. The work embraced in connection with the construction of this new reservoir required laying a mile of 60-inch steel supply pipe from the watershed conduits to the reservoir; the building of a seven-foot outlet tunnel 3,000 feet long, and the laying of about seven miles of 60-inch steel pipe from the tunnel to the city. The work has been under contract for about two years and is nearing completion.

The reservoir basin is about 5,000 feet long, from 1,000 to 1,500 feet wide, and will have a capacity of 700,000,000 gallons. Incidentally it is desired to secure from the new reservoir all the possible benefits from the storage of water, including the advantages of sedimentation, and to attain this end with the configuraion of the ground, it was necessary to plan for 4,000 feet of single 5-foot pipe and 1,500 feet of double 5-foot pipe along the bottom of the reservoir. These pipes or conduits inside the basin are being built of concrete reinforced with an expanded metal core.

The section of the bore of the conduits is not far from a circle 5 feet in diameter, and the thickness of the walls is 10 inches. The concrete is mixed in the proportion of one of Portland cement, two of sand and five of 1½-inch stone, and the expanded metal is No. 10 steel with 3-inch mesh. In general, in operating the reservoir, the head of water in the conduits will be balanced by that outside; but at times the basin may be full and the conduits empty or the

conduits may be run under a head with the basin empty. The greatest head possible will be 45 feet.

Not much concern was felt as to the strength of the concrete with the reservoir full and the conduits empty bringing the pressure on the outside, but to withstand an internal bursting pressure of 20 pounds per sq. in., which will bring a tensile stress of 80 pounds per sq. in. on the concrete, it was realized that the conduits must be constructed so as to develop the fullest possible strength of the concrete. For this it was essential that entire sections should be built as monoliths, the concrete being put in continuously around each section, avoiding horizontal joints.

Some difficulty was experienced in getting proper forms, etc., to make this monolithic work successful, but after a little experimenting the conduits were built as easily by this method as they could have been by any other.

In the double conduits about 30 linear feet was a day's work for the force of men employed, and an expansion joint was made at the end of each day's work. It has a depth of about six inches. The concrete has been laid principally in warm weather, and at the present time these joints show an opening of perhaps 1-32 of an inch. No serious leakage, however, is apprehended, and as the conduits are entirely within the reservoir basin a slight leakage at these joints will in no way impair their usefulness.

Last December some experimental sections were built, a section of single conduit and a section of double conduit. The double conduit was built practically as a monolith, but the construction of the single conduit was interrupted, and a horizontal joint was made in its section. Both of these sections were tested under hydraulic pressure, wooden heads being bolted to the ends so that the sections could be filled with water. The single conduit gave way at the horizontal joint under a pressure supposed to be about 15 pounds, the pressure being accidentally applied before the time set. The double conduit was tested up to 35 pounds, which was as much pressure as could be obtained with the heads used. The concrete showed no signs whatever of weakness, and this section has been incorporated as part of the permanent work.

NEWARK, N, J., WATER-WORKS.
Concrete-Steel Conduit, Under Construction.

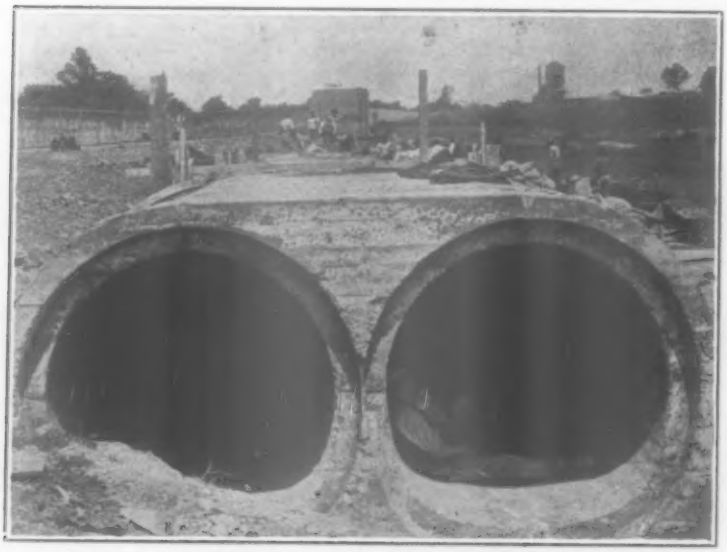
A comparison of the cost of these concrete conduits with cast iron pipe is interesting. Sixty-inch cast iron pipe could be obtained at the time contracts for this work were let, for $26.40 per ton of 2,240 pounds. The pipe would weigh about 1,000 pounds per foot and would cost to lay $2.20 per foot, making a total cost per foot outside of any excavation, of $14.00 for a single line, and $28.00 for a double line.

The double concrete conduit has 1½ cu. yds. of concrete per foot and the single ¾ cu. yd. of concrete per foot; the former also has 48 sq. ft. of expanded

metal per foot, and the latter 26 sq. ft. of metal per foot. Contract prices for concrete and expanded metal were respectively $6.20 per cu. yd. and 5 cents per sq. ft., thus giving cost of single conduit $5.95 per linear foot and cost of double conduit $11.75 per linear foot.

In making a comparison between cast iron and concrete the cost of excavation was assumed the same in both cases, but as cast iron pipe 60 inches in diameter will float when empty, and as the concrete conduits will not, an additional charge per foot must be added to the cast iron pipe for cost of holding it down. For the single line in this particular case to load it would have meant a deeper trench at an added cost of about 60 cents per foot. For the double line it would have meant a fill over the pipes at an additional cost of about $2.00 per foot.

For steel pipe, used in this work for the same purpose, the pipes themselves would have cost less, but the expense for loading would have been very much greater and it would have been necessary to provide some arrangement to strap down the pipe to prevent floating when empty. A comparison of the actual cost of steel pipe and concrete conduits has not been made, as the use of steel pipe in this manner in the bottom of the reservoir, was not considered advisable.



NEWARK, N. J., WATER-WORKS.
Concrete-Steel Conduit.

In round figures and at the present prices of cast iron pipe the cost of a 5-foot single concrete conduit may be placed at $6.00 per foot, approximately one-half the cost of cast iron pipe. The total saving by the use of concrete conduits on this work was over $40,000.

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## TAXATION.

*By G. M. Ballard, Newark, N. J.*

Taxation in the public laws of the state of New Jersey signifies the system of raising money for the public purposes. Authorities of world-wide repute differ as to the definition of taxation, in fact the old theory that taxes are payments for protection has been attacked with severity by modern authors and by many utterly repudiated as a pure fiction without foundation. Prof. Ely in his work on

taxation in American states and cities gives the following definition, which seems to have met with the largest approval: "Taxes are simply one sided transfers of economic goods or services demanded of citizens and occasionally of those not citizens but who, nevertheless, are within the reach of the taxing power, by the constituted authorities of the land, for meeting the expenses of the government, or for some other purpose, with the intention that a common burden shall be maintained by common contribution or sacrifices."

Many officials charged with the imposition and collection of taxes are of opinion that the words taxes and assessments are synonymous terms. I hold that in law and practice such is not the fact. Taxes are and of right should be a burden imposed upon all persons and property alike, upon some well established principle of equality and uniformity. In the state of New Jersey so universal was this contention that the framers embodied it in the constitution of the state in the following language: "Property shall be assessed for taxes under general laws and by uniform rules according to its true value. Assessments are not burdens at all in the sense that taxes are. They are merely benefits or equivalents and are generally imposed on property benefited only.

New Jersey is not alone in requiring that "property shall be assessed for taxes under general laws and by uniform rules according to its true value," as the same language or its equivalent appears in the fundamental laws of many of the states, so that it would seem that no matter what methods or systems are in operation in the several political subdivisions of the nation—the underlying thought seems to be that wherever the imposition of taxes is a necessity, the method of levying the tax should be such as would seek to serve all alike, and yet I venture to say that, should a fair unbiased, but searching examination of the laws enacted by the law-making powers of the several states covering the methods under and through which values for taxation are determined and exemptions permitted to be made, it would disclose conditions under which nearly one-third of the actual value of all the tangible and intangible personal property escapes taxation and the value of real property is determined by such loose, ignorant and unbusiness-like methods that nearly as large an amount of actual values are exempted and consequently lost to the taxing authorities. Nor is this all. The examination referred to will disclose that great loss is sustained through the acts of legislators who through charity or fear or both have enacted laws, the operation of which permits the wholesale exemption of the following classes of property: The real and personal property controlled by religious, quasi-public and so-called beneficent agencies or organizations; the holders of national, state and municipal securities; the swearing off of indebtedness even against realty, property owned by soldiers and sailors, firemen and policemen, and even members of the national guard; to which must be added the exemptions more prevalent at this time than ever before in our national history, those that result from the enactment of discriminating laws, that are being considered at every meeting of the law-making powers of nation and state, through the insistence of agents of the vast aggregations of capital commonly known as trusts. Permit me to say that in my opinion change will never come until men of courage in every department of government will by united effort cause the repeal of such laws as permit what in a general way I have set forth in this paper, and in their stead, enact such laws as were intended by those who placed in the constitution of many of our states the provision hereinbefore quoted, through which it was evidently intended that all property should pay taxes and no exemption should be permitted. So far as real estate is concerned I believe the rules should be first, assess the land, so that proper equalization could be determined, and after that is done the betterments should be considered, under uniform rules according to their true value. As to personal property I believe that all personal property whether tangible or intangible should be taxed, and in order that fraud in returning such property for taxation be minimized. I would make every holder his own assessor and enact laws, such as are in force in some parts of Europe, to wit:

That the settlement of all estates be vested in the control of the taxing authorities, and if in the settlement of the estates of deceased tax payers, it is found that false returns were made, that the estate shall be liable.

In conclusion, permit me to express the belief, that should laws be enacted that would carry out the scheme of taxation above stated in a general way, every real need would be met, and the burden of the individual be lessened.

## THE MAKING OF A CITY.

*By William Fortune, Indianapolis, Ind.*

The powers of the individual are developed by effort. The possibilities of a community are developed by the united efforts of individuals. Progressive citizens make successful cities. Villages grow into towns and towns grow into cities by the efforts of men more than by force of circumstances.

On the shores of Lake Michigan many points could have been found a hundred years ago more advantageous for commerce and more attractive as a place of habitation than the miasmatic expanse of swamp and the sun scorched patches of barren sand from which sprang the magic city of the world—Chicago—the growth of which represents the mighty struggle of progressive men against formidable difficulties of location. The inherent greatness of Chicago is demonstrated in the wonderful engineering triumphs made possible by the enterprise and liberality of Chicago people, by the colossal projects promoted with the greatest outpouring of public spirit known in the history of the world. Chicago is not a model city, but it is a wonderful example of public and private enterprise, of rapid commercial development. Men have made it so, and in making it so they have had to overcome seemingly insurmountable difficulties. They do great things and they have great results. As officials charged with the duty of doing things for the public you are all more or less familiar with that kind of do-nothing citizenship which as a shield from contempt calls itself "conservatism;" and it has doubtless sometimes caused you to wonder why you are officials charged with the duty of doing things for a public that would not permit you to do anything.

Among the men who help in the making of cities the man who does things and makes mistakes is more useful to the world and is a better citizen than the man who makes no mistakes and does nothing. The man who does nothing but make mistakes, however, is a nuisance. Fortunately, he is usually a self-abating nuisance, when allowed time and opportunity to find himself out ,and then he settles down to a conservative citizen, who sees in everything what he has found in himself.

The do-nothing men do not make cities; they do not belong to cities—the pace is too swift for them. They are better suited to the quiet retreats where slumberous life is not disturbed by the great problems of urban progress. For them Riley's little town of Tailholt is good enough. The non-progressive citizen becomes powerful, as a rule, only in numbers, and even then there is hope, for a few earnest men can accomplish wonders in advancing the interests of a city when they devote themselves faithfully to the work. One man can sow the seeds of an idea which will spread through and take possession of an entire community. The power of an idea is one of the wonderful things of life. If it is good and beneficent, if it is based on facts and appeals to reason, it will overcome all opposition; in fact, opposition is but a stimulus to it. I believe that there is nothing surer than the ultimate success of a truly good cause. But like the great oak that comes from the little acorn, it must grow; it cannot be brought to full development by any quick trick of magic.

As a city is whatever its citizens make it, primarily responsibility rests upon each citizen to the extent of what he may do to make it greater and better. If there is no public spirit in a community, if every man is looking only to his selfish interests, the conditions will be relatively such as are produced in the individual by narrowness and selfishness. If the leading citizens are broad-minded and progressive, if they are alive to the public interests and are active in trying to improve the facilities and advance the welfare of their community, the spirit of enterprise will quicken the life of the place, will develop its best material possibilities, will make it a city in which all will have cause to feel pride. The people of such a city will not be pessimists and grumblers, they will not look enviously on the progress of other towns; they will be happy in doing their best for their own abiding place. A few men can arouse this spirit in any town if they go about it in the right way.

The right way leads to the real things of life—the things that make health, happiness and comfort. Progressive men, with good ideas and great energy, do the best work in the making of cities. Spasms of reform may make cities good a little

while, but rarely long. Boomers may make them seem big, but hot air and water are elements that make fat for the boomer only.

In the making of a city there is more to be considered than the promotion of plans merely for business growth. Business is not all of life; it is not all of a city. Good equipment is the best preparation for successful production. Good physical condition is of primary importance in the making of a city. This is the basis of substantial growth. I have never found an instance of a city having really suffered from the effects of good physical improvement, and I have never known a city that did not suffer from lack of it. Paved streets, adequate sewerage, good water, well lighted thoroughfares, ample traffic facilities, attractive parks are essential features of a successful city, and the power house for it all is efficient municipal government, conducted on sound business principles. The power house is the starting point in the system, in construction as well as in operation. Municipal progress is well near impossible without responsible, efficient, honest government, and government of this kind is well near impossible under the unbusinesslike and irresponsible political juggling tolerated in many benighted cities and towns where more consideration is given to an engineer's training in ward politics than to his technical training and experience, where the brand of partisanship is given more consideration than the value and ability of the man in the work to be done. Happily, these unworthy considerations are no longer dominant in the most progressive cities, but they are still found as the barnacles of a bad system clinging to the less progressive and most inefficiently governed cities. When a city brings to its people the facilities that give them equal advantage with the best equipped centers of population it will attract others who seek the best locations, it will lead to broader realization of the good things of life, it will stimulate civic pride, and when a swelling sense of superiority takes possession of a people who sincerely feel that they have a city to be proud of, then and not until then is the ambitious community moving toward success.

# EDITORIAL COMMENT

**Municipal Improvement Conventions.**

**The Cement Situation.**

## MUNICIPAL IMPROVEMENT CONVENTIONS.

The two conventions of municipal officials held in October apparently had the usual attendance or a little better, and that of the American Society of Municipal Improvement was particularly successful. This number of Municipal Engineering is largely given over to the reproduction of abstracts of the papers presented at the two conventions, be-

C. H. Rust, Ex-President A. S. M. I., City Engineer, Toronto, Ont.

cause they are of definite and special value to the many among our readers who are interested in municipal work. Some papers are held for publication in later numbers because of lack of space for all, even though the space usually devoted to other matters has been largely encroached upon.

The lists of delegates show that the League of American Municipalities is largely made up of those who are in the legislative branch of the city government, including, however, the mayors, while the American Society of Municipal Improvements draws its membership from those in the administrative branch, especially from the heads of departments and their principal employes.

It is evident that these two classes of officials will, in general, desire to discuss municipal imporvements in different ways, and that there is a need for both societies. It is equally evident that in cities where the legislative branch, city council, is also largely the administrative branch, through its direct management of municipal affairs, the consideration of the problems which arise from at least a semi-technical standpoint is much to be desired. It is also true that the administrative officer will find benefit in studying the point of view of the legislative officer.

Attendance at both conventions has heretofore been difficult on account of their locations and occasionally of conflict in dates. The recent suggestion of same date and place for holding conventions, made by this magazine in line with the efforts of some other societies in the same direction, has been followed by the suggestion of President Rust in his recent address to the A. S. M. I., and by a prominent member of that society in the convention, that the officers confer with the proper committee of the league with reference to such common action.

As heretofore stated, it is not desirable that the two organizations combine, but independent conventions at the same time and place will prove very satisfactory to both. It is to be hoped, therefore, that these two societies, at least, can select the same time of meeting at St. Louis, since both have chosen practically the same place. If the other societies which have been moving in this direction can be brought to St. Louis at the same time the benefits of this concerted action will be still further extended.

## THE CEMENT SITUATION.

The rapid increase in the number of cement mills and the large fluctuations in cement prices apparently cause much uneasiness in some localities and doubts that investments in new cement manufacturing enterprises are well advised. There are some disquieting factors, but on the whole the outlook is exceptionally bright for legitimate investments on a cash basis.

In the first place, a high price for cement is not desirable, first because it greatly restricts consumption, and in the second place because it offers too much temptation to promoters to overcapitalization and consequent overloading of the fixed charges of the plant. Cement at a dollar a barrel at the mill, as at least one manufacturer has said, is more satisfactory than at $2, for those whose companies have no water in their stock and no expensive mistakes in location and design on account of insufficient time and care in laying the plans and investigating the materials.

Cement, like all building materials, is subject to fluctuations in demand on account of the money and labor markets. German cement mills have recently passed through a period of stress on account of financial stringency which greatly restricted building operations and thus diminished the demand for cement at the same time that the capacity of mills had been largely increased. The American mills are passing through a similar period, not so serious because the diminution in demand for cement is due to labor troubles only, and so work is not at so complete a standstill, many minor operations being even extended by the resulting saving to them in cost of cement.

These fluctuations in demand are specially hard on plants which must carry a load of water in addition to the legitimate charges upon them, and should have the effect of restricting cement investments to those on a strictly legitimate basis. They are hard enough on any plant, but they are inevitable under present conditions and are no worse than in most other branches of manufacturing.

Cement should be a cheap material, and the amount of freight charge which it can afford to carry is not large, though often a large proportion of the cost of the cement. Naturally, therefore, in countries in which cement materials are as widely distributed as in the United States and Canada, the question will ultimately become one of locality. The large concerns recognize this when they locate their new mills in different sections of the country so that their trade can be taken care of at a minimum charge for transportation, and the smaller plants must be governed by the same condition. New projects, especially, must first study the demand in the locality of the proposed plant and if this is sufficient to support a factory can expand their territory later as opportunity offers. The general proposition that the cement business is a good one and pays large profits is a very poor basis upon which to build a project unless it can be shown that a local demand for cement enough to operate the plant successfully can be developed.

It is a fact that the cement business in a good business and that there is a large development to be expected in the near future, but unless investors proceed on conservative lines they will fail to find the truth of the general proposition and will help to make cement business poor, at least temporarily, in the locality of their plant.

The business is good and its further development is inevitable, because there are many uses of cement which are only beginning and new uses are developing every day. An increase in the per capita use of cement in America to that in Germany would require much more capacity than our mills now have and increase in population and extension of cement uses will still further increase the demand for new mills. The business has scarcely got out of its swaddling clothes and when it reaches its full stature its size and vigorous growth will be far beyond present expectations.

The present condition as to fluctuations in demand and prices depends not only upon the conditions in the money and labor markets, which we will have with us for many years to come, but also upon the total inability of the existing mills to supply the legitimate demands for cement in average times. The increase in demand acts to increase the price, which in turn makes cement too expensive for many classes of construction, so that the old forms and materials cannot be displaced. Prices soar and work in which cement is an essential is made inordinately expensive and as much of it as possible must be postponed to a more convenient season.

Then comes a sudden influx of new capital into the business, often accompanied by too much paper imitation, in an attempt to meet the demand and to

reap the benefit of the large profits. A subsequent financial stringency or labor trouble stops the work in which the cement is an essential and the rapid accumulation of stocks of cement sends the price down. If the price remains low long enough the application of cement in works where it is an alternative increases and not only takes all the old stocks but demands more. The difference in cost of cement and the materials which it displaces is so small that any great increase in price again contracts the demand. Meanwhile the labor or financial trouble is settled and the demand again increases rapidly and the cycle is again repeated. The fluctuations should become less as the capacity of mills approaches the legitimate natural demand, but some of the factors are thus far uncontrollable and their action must always be expected. The legitimate natural demand cannot all be developed until cement becomes low in price, so low that it gives no more than a legitimate business profit, allowing for the dead times which are inevitable. That demand will then be many times what it is at present.

To the writer, therefore, the future of legitimate investment in cement properties well located and designed with full consideration of all the points mentioned, is bright, and a rapid increase in the number of successful cement mills is confidently predicted. Undoubtedly the water will be squeezed out of most propositions which contain it and some good plants may suffer in the operation, but on the whole the rapid advancement of the industry is certain.

# THE QUESTION DEPARTMENT

## QUALITY OF CEMENT.

During a prolonged rain storm a few wagon loads of natural hydraulic cement for a pavement, being uncovered, got wet through. Some time afterward I walked up to a sack of it and gave it a kick with my shoe heel and broke it up like chalk. Now I thought that if it was even fairly good it would not have crushed so easily. The concrete made with this cement has no adhesion but can be picked to pieces with a pocket knife. Would you consider this concrete suitable for foundation for brick pavement? It may be a very slow setting cement and become better after a few months. Should not good concrete be so hard and cemented together that it would be a difficult matter to take is up with a pick? Some Portland cement got wet at the same time but it got so hard that wagon wheels did not break it up.

SUBSCRIBER, ——, Okla.

The test described is hardly a fair one, the completeness of the hardening depending on so many conditions which might not be fulfilled in the case as stated. Natural hydraulic cement never becomes as hard under such circumstances as Portland cement. It requires more water and the outside of the package might easily prevent the access of sufficient water to the inside to make complete the chemical process. In such case the packages might act as described and the cement be reasonably good natural hydraulic cement.

In practice it is seldom that a natural cement concrete foundation for a pavement can not be taken up with a pick with comparative ease. This is partly from the nature of the cement, and partly from the fact that less care is taken in laying work with natural cement, so that it does not develop its full strength. It takes longer to reach its full strength also. While such action as that described should not of itself condemn the cement, it should lead to proper tests to determine its actual quality.

## EFFLORESCENCE ON SURFACE OF CEMENT WORKS.

The use of precipitated carbonate of barytes is suggested by Gabriel and Schall of New York for preventing the efflorescence on cement surfaces, discussed in Municipal Engineering, vol. xxiv, p. 435. Their circulars describe the use of the substance for preventing efflorescence on brick surfaces, the carbonate of barytes being mixed with the clay in proper portions before burning. The propriety of the same use of the carbon-

ate of barytes in cement is suggested, before or after burning. The latter would not be consistent with the practice of adding a small proportion of gypsum to the clinker before grinding. Have any of our readers made or seen the results of the use of this substance and if so will they report them for the benefit of others?

## PRODUCTION AND IMPORTATION OF CEMENT IN 1901 AND 1902—COST OF MAKING CEMENT—BUILDINGS OF CONCRETE.

1. Referring to the tables on pages 25 and 28 of the Directory of American Cement Industries we would like the same information for the years 1901 and 1902 which is there given for the years prior thereto.

2. If you have at hand a table showing the price per barrel of Portland cement during the last ten or twenty years as reported to the government I should be greatly obliged for a copy of it.

Allow me in this conection to express to you my very high appreciation of the great service which you have rendered in compiling and publishing the directory.

3. What definite information can you put me in posession of concerning cost price of cement? I notice that specialists differ not a little in regard to the actual cost of making the article. Are there any reliable data on the subject and where can I get them?

4. Can you put me in possession of definite information concerning the use that Portland cement is put to in the construction of buildings, large and small, and where such buildings are in greatest number?

LUTHER D. WISHARD,
Chicago, Ill.

To the table on page 25 of the "Directory of American Cement Industries and Handbook for Cement Usuers" ($5) referred to, the following may be added:

| Year | 1901 | 1902 |
|---|---|---|
| Number of works | 56 | 60 |
| Product, barrels | 12,711,225 | 16,875,506 |
| Value | 12,532,360 | 17,000,000 |

There are no official figures for the value of the Portland cement made in 1902 and the figure given is merely an estimate. The number of works is also estimated. Reference may be made to Municipal Engineering, vol. xxiv, p. 83, and vol. xxv, p. 36, for further details, the former article being quite an extended discussion of the condition and prospects of the cement industry for 1902 and 1903. That the estimates there given are conservative is shown by the fact that the estimated production for 1902 was 14,400,000 barrels and the figures for actual production, received five months later, show 16,875,506 barrels manufactured in 1902.

To the table of total consumption of cement in the United States, on page 28 of the "Directory," the following may be added:

| | 1901 | 1902 |
|---|---|---|
| Natural hydraulic, brls.. | 7,084,823 | 9,083,759 |
| Per cent. for year ..... | 33.6 | 31.8 |
| Imported Portland ..... | 994,623 | 2,099,779 |
| Per cent. for year..... | 4.7 | 7.4 |
| Domestic Portland ..... | 12,711,225 | 16,875,506 |
| Per cent. for year ..... | 60.4 | 59.1 |
| Puzzolan ..... ..... | 272,689 | 478,555 |
| Per cent. for year ..... | 1.3 | 1.7 |

The "per cent for year" in this table is the ratio which the use of each kind of cement bears to the total amount of all kinds of cement used during the year.

It will be noted that puzzolan enters this table first in 1901. Prior to 1900 very little cement was made in this country from slag, either in the form of Portland cement or of puzzolan, but the amount is rapidly increasing each year and will soon form a large percentage of the total production. The cement made from slag by Portland cement processes is included in the items for Portland cement. Only the slag cement or puzzolan, according to the now accepted definition, is included in the items for puzzolan, which is neither Portland nor natural hydraulic cement and is also becoming important enough to be placed in a separate class.

2. The average price per barrel at the mill, not including packing, may be determined by dividing the values in the table on page 25 by the respective numbers of barrels. This has been done in Municipal Engineering, vol. xxiii, p. 46, and vol. xxv, p. 176, where will also be found average prices in New York for the same years. There is a rapid reduction in mill value from $1.62 in 1898 to $.99 in 1901. The price is probably increased in 1902, for the reasons discussed in the latter article referred to. Values have been given in the reports of the U. S. Geological Survey since about 1890 as shown in the table on page 25 of the "Directory." The present conditions as regards price are quite unsettled, first, on account of the fluctuations in amount of building, which are largely dependent on labor troubles. In the second place, periods of low prices, like that of 1901, develop new uses for cement and increase the demand. This reacts upon the price and in turn the demand is decreased. American use of cement is yet far from as great as German use, and, barring in-

dustrial depression, there is room for several doublings of production before the new uses are all found and the utmost extension of old uses is made.

Cement prices are bound to have large fluctuations for some years, until the status of the material in the world of construction is settled. A low mill value, such as that of 1901, gives great impetus to the use of cement and is probably quite as satisfactory to large manufacturers as higher prices with more restricted sales.

3. The great change in methods of making cement, brought about by the invention of the rotary kiln, has made all former statements of cost of making cement useless. The improvements in burning and grinding machinery and in the designs of cement mills have been introduced very rapidly, and it is probable that the mills of latest design have reduced the cost of the work inside the mill to a minimum. The cost of getting the raw material to the mill and into a cement mixture evidently depends upon the character of the materials, their distance from the mill and the difficulty of quarrying them. Those who have developed economies in manufacture are naturally careful not to reveal the exact figures of cost, so that the only information now obtainable is from estimates of cost made by experts for developers of cement properties and similar purposes. These differ with the materials and their mode of occurrence and are somewhat biased, sometimes, by the circumstances under which they are made. Several of these estimates are obtainable in the prospectuses of cement companies. Two of these estimates are abstracted in Municipal Engineering, vol. xxii, p. 229. One gives the cost of Pennsylvania rock cement as 65 cents a barrel, with cost of getting the material to the mill 20 cents a ton. Another gives the cost of Michigan marl cement as 73 cents a barrel in a 1,000 barrel plant. Change in local conditions will change these figures. In the series of articles on "Portland Cement Manufacture," which began in Municipal Engineering for May, 1903, will be found occasional estimates of the cost of various details of the processes, which, being general, must necessarily be made between limits which will cover ordinary variations of material, location, methods of manufacture and management.

4. Reference may be made to numerous articles on concrete buildings in Municipal Engineering. Some of the most important are "Concrete Building Construction," vol. xxiv, p. 88; "A Few Applications of Concrete-Steel in Building," vol. xxiv, p. 128; "Concrete for Apartment House," vol. xxiv, p. 357; "The Use of Concrete in Architecture," vol. xxiv, p. 256; "Concrete for Buildings," vol. xxi, p. 214; "Concrete Building Construction," vol. xxiv, p. 88; "A Concrete Dwelling," vol. xxi, p. 362; "Concrete vs. Brick and Stone Masonry for Buildings," vol. xxii, p. 20. There are many others on various details of building construction and methods of work. Every large city now has numerous buildings made of concrete by various methods. In Chicago there are several firms who make a specialty of this method of construction. Reference to the advertising columns of Municipal Engineering will give the names of some of them. The city now has many examples of their work.

## SOLUTION FOR MAKING CONCRETE IMPERVIOUS.

On page 219 of your "Hand Book For Cement Users" you mention double silicate of soda and potash for making cement concrete impervious to water and air. I will thank you for any information as to where I can get the double silicate. I have tried the wholesale drug store.

G. A. DAMEIER
Chicago, Ill.

The silicate of soda is on general sale as "water-glass" and can be purchased in quantities at about 50 cents a gallon. Quotations on solution of silicate of potash from Elmer & Amend, New York importers, give 85 cents as the cost of that substance. The two together or the silicate of soda alone may be used for the purpose named. Can our readers give definite information about places they have purchased and prices paid?

## TESTS OF AND INFORMATION ABOUT MARL.

I have some marl which I would like to have tested as to its value for cement. I have been referred to you as being most likely to know by whom this could be done. Are there any government or other reports dealing with marl deposits and cement works? Very truly yours,

HENRY C. WRIGHT,
Cincinnati, O.

Reference may be made to the "Business Directory" in our advertising columns under the headings "Cement Plant Designers," "Chemical Tests," for names of competent men who can make the desired tests.

The U. S. Geological Survey has paid

much attention recently to cement materials. Recent papers on "Portland Cement in Michigan," "The Chalk of Southwestern Arkansas," etc., are valuable. These and other papers on similar subjects can be obtained on application to the Director of the Survey, Washington, D. C. The State Geologist of Michigan, at Lansing, has recently published a comprehensive report on the marl deposits of that state.

## PATENTS ON CEMENT BLOCK MACHINES.

Is there a patent on the Seaman's cement block machine, and, if so, what are the points protected?

KISER & WILLIAMS,
Muncie, Ind.

Patent No. 720,536 on a mold for concrete blocks, was issued to Edward W. Seamans, Grand Rapids, Mich., Feb. 10, 1903. The first claim is as follows: "In a mold the combination of sides and ends detachably secured to each other, a bed-plate, a core attached to the bed-plate and projecting within the mold, a stripper plate having an opening through which the core extends, and stops on the stripper plate to locate the sides and ends of the molds thereon." The other four claims put the stripper plate between the bed plate and the mold, add partitions to the combination, open-end slots in the ends of the sides, ends abutting against the sides, adjustable blocks to locate the ends, bolts in the blocks and adjustable in the slots, clamping bolts inserted in the slots, the form of openings in stripper plate, reversible sides and ends having one side plain and the other side recessed, cores rigidly attached to the bed plate stops on one of the sides, and a plank to engage the stops and receive the contents of the mold when the same is reversed.

If the patent office reports are not on file in the public library or elsewhere in the city, a copy of the patent giving full specifications and drawings can probably be obtained from the commissioner of patents, Washington, D. C., for 10 cents.

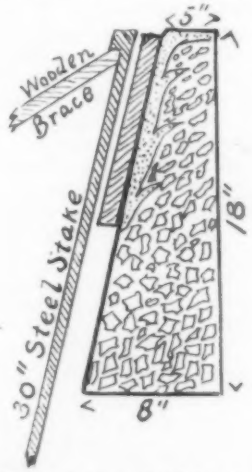
## A SUCCESSFUL FORM OF CONCRETE CURB.

In response to the request in the October number for reports on special forms of concrete curb Mr. C. W. Chappell of Eau Claire, Wis., contributes the following:

"I notice in the October number of Municipal Engineering a communication from Percy Lunar of Clarksburg, W. Va., giving a description of concrete curb, and as you ask for another experience, if you will allow space in your valuable magazine I will give you the result of my work in that line. I have been manager for the Chappell Concrete and Tile Company of this place for the past fifteen years, during which time I have sought to do the best work possible, for the money I was getting.

"We first made curbing with vertical walls on both sides, but soon found out that a much better curb could be made with less cement by making the side next to the gutter battering and proceeded to do the work in the following manner:

"First excavate to the required depth of curb, say eighteen or twenty inches, using the earth on one side as a mold, where conditions will admit of it. If the soil is sandy no provision need be made for drainage. Next we set up a mold two inches thick, twelve inches wide




and sixteen feet long, held in place with seven-eighths inch steel stakes, set so as to make a curb eight inches thick at bottom and five inches at the top. Then proceed to fill space with concrete, sliding the mold up as required, until the finish line is reached, then float and trowel on the top and twelve inches down on the face. Cut deep into sections with pointing trowel say three in sixteen feet. Finish front edge to straight edge with quarter-round. Trim edge next to lawn to straight edge, leaving that edge sharp. This makes an ideal curb, looks well, stands well and is well. Note the manner in which the facing is anchored to the backing, as shown in the accompanying sketch. After troweling, brush the work to give it the appearance of sawed stone. We do not consider it necessary to use any metal in constructing curb."

## BOOKS ON CONCRETE-STEEL CONSTRUCTION.

Will you kindly advise me as to the best work on concrete steel construction and designing of same?

WALTER P. RICE, C. E.,
Cleveland, O.

There are no books on this subject in English at present except those named in the article elsewhere in this department entitled, "Books on Steel-Concrete Arches." There are some excellent pamphlets issued by the proprietors of various systems of reinforcement of concrete. One of the most valuable of these with which the writer is acquainted is "Thacher Bars for Concrete-Steel Construction." Others are to be obtained. Reference may be made to our "Business Directory" under the heading of "Concrete-Steel Arch Bridges" for a number of names of constructors of such work.

There are two interesting little French books on the subject, viz.: Christophe's "Le Beton Arme" and Morel's "Le Ciment Arme et ses Applications," reviewed in Municipal Engineering, vol. xxv., p. 195, September, 1903. The subject is under development and several papers have appeared in proceedings of engineering societies and engineering periodicals upon special forms of concrete-steel construction. A very little on this subject may be found in text books, such as Johnson's "Materials of Construction."

## BOOKS ON SURVEYING, PAVING AND DOCKS.

What books have you treating of city surveying, street paving and dock construction? VICTOR HOMMEL,
Sandusky, O.

On city surveying the chapters in Staley's Gillespie's "Higher Surveying" ($2.50) and Johnson's "Surveying" ($4) are recommended.

On street paving Baker's "Roads and Pavements" $5) is the latest and perhaps the most comprehensive. Judson's "City Roads and Pavements" ($2) is a clear and short exposition of pavements for small cities. Tillson's "Street Pavements and Paving Materials" ($4) is a very valuable book, especially for the larger cities. Byrne's "Highways" ($5) has some good discussions of street paving problems. The books are arranged in this list in the order of their probable value to our correspondent, the comment perhaps enabling him to correct the order if necessary.

Upon dock construction reference may be made to such books as Mahan's "Treatise on Civil Engineering" ($5), Allen's "Theory and Practice in the Design and Construction of Dock Walls ($2.50), an English book. The principles and methods of construction are treated in Baker's "Masonry Construction ($5), though not applied directly to dock construction. Fowler's "Coffer-Dam Process for Piers" ($2.50) may be found valuable in this connection.

## BOOKS ON STEEL CONCRETE ARCHES.

Kindly advise me of any description, pamphlet or book on the subject of steel-concrete arches, especially as used for bridges. T. WM. RAEDER,
Monterey, Mex.

Cain's "Theory of Steel-Concrete Arches" (50 cents) and Howe's "Treatise on Arches" ($4) treat the subject from the theoretical standpoint. The "Directory of American Cement Industries and Handbook for Cement Users" ($5) is the most complete book upon practical construction. Numerous articles on concrete and concrete-steel arches will be found in Municipal Engineering, such, for example, as those in vol. xix, p. 388; xx, p. 63; xxii, pp. 137 and 155; xxiv, pp. 436, 453, 127.

## BOOKS ON ASPHALT SIDEWALKS.

I wish to purchase a text-book on asphalt paving with especial reference to sidewalks. C. E. TWITT,
Tampa, Fla.

Byrne's "Highway Construction" ($5) contains the fullest treatment of the subject of asphalt sidewalks given in any text-book. It occupies eleven pages and includes specifications from Washington and Paris.

## BOOKS ON STEEL BRIDGES.

What can you recommend as a good, practical and complete working text-book for a beginner on designing, estimates and construction of steel bridges, and what are the prices? W. R. K.,
—, O.

Johnson's "Theory and Practice of Modern Framed Structures" ($10) is perhaps the best book answering to all the requirements stated. There are several others covering part of the field, some in simpler form and in more detail, but for a single book covering the whole field of the question this one is specially recommended. It was prepared under the editorial control of Mr. Johnson, by himself

and Messrs. Turneaure, Bryan, Molitor and others, thus securing treatment of all branches of the subject by authors with special training with each.

## ROLLS FOR CRUSHING ASPHALT ROCK.

Who make Crook rolls for crushing asphalt rock? READER,
Indianapolis, Ind.

The apparatus mentioned does not seem to be on the market. Can any of our subscribers give any information about this or any other machinery for the purpose named?

## MACHINERY FOR MAKING SHEETS OF BITUMEN FOR DAMP COURSES, ETC.

Can you tell me of a firm who manufactures an outfit for making pure bitumen sheetings or linings of ¼ to ½-inch thickness? It is the bitumen damp course which we wish to manufacture.
D. SZENDE, Budapest.

This inquiry is referred to our readers. We will publish the addresses of manufacturers of such machinery if sent to us.

## ASPHALT FOR PAVING FROM OIL.

Could you furnish me with any data as to where asphalt for paving is mined or refined from oil? I desire simply to know the localities. SUBSCRIBER,
Ann Arbor, Mich.

The twenty-second annual report of the Director of the United States Geological Survey, Part I. contains a paper on asphalt and bituminous rock deposits in the United States, to which it is assumed that the question is restricted. This report gives analyses of asphalts from Trinidad, B. W. I.; Bermudez, Venezuela; Cuba; Asphalto, Venturo, Punta Gorda, La Patera, Waldorf, Santa Maria, Cal.; Utah, Indian Territory, Arkansas, West Virginia, Mexico; of asphaltic sandstones from eastern and western Kentucky; Higginsville, Mo.; Buckhorn district, Indian Territory; Santa Cruz, San Luis Obispo, Los Alamos, Carpinteria and the Sisquoc region, Cal.; and of asphaltic limestones from the Buckhorn district, Indian Territory, and Uvalde Co., Tex. The definite locations of mines are made in the descriptions in the report, with some statement of the uses which are made of the material. Not all are available for paving. Roughly the following list represents the location of deposits which have been drawn upon for paving material or are considered useful for that purpose. It is not carried to detail of locations of individual mines or quarries: Near Soldier, Carter Co.; Garfield & Harned, Breckinridge Co.; Leitchfield, Grayson Co.; Young's Ferry, Warren Co., and Russellville, Logan Co., Ky.; near Atoka and Antlers, in the Buckhorn and Brunswick districts; near Dougherty and near Ardmore, Ind. Ter.; near Cline, Uvalde Co., Tex.; near Fort Duchesne, Culmer and Rifle, in Utah; near Pt. Arena, Mendocina Co.; Santa Cruz, Santa Cruz Co.; Metz, King City, San Ardo and Bradley, Monterey Co.; San Luis Obispo, San Luis Obispo Co.; Waldorf, Sisquoc, Lompac, Los Olivos, Santa Barbara, Santa Barbara Co.; Carpinteria, Ventura Co.; Chino, Los Angeles Co.; McKittrick, Kern Co., Cal.

Asphalt for paving and other purposes is extracted from the oils of Texas and California, which have an asphaltic base, at several places, notably Beaumont, Tex., and Los Angeles, Cal., and vicinity. Reference to the "Business Directory," on page 9, under the heading "Asphalt," will show the names of a number of companies furnishing asphalt from these various deposits and refined from oil, and under the heading "Asphalt Pavements" will be found names of firms laying pavements with these materials.

## MAKERS OF TAR MACADAM STREETS.

I wish to make a trial of coal tar macadam in Dubuque and expect to arrange with the city authorities for laying coal tar macadam on one of our streets and to give the city a guaranty of service, relieving the city of all risks. I shall be very much obliged to you if you will give me directions for preparing and laying coal tar macadam. I wish, especially, to learn what quantity of tar to use and how to boil and prepare the tar properly. I wish to know whether rosin or any other substance should be mixed with the tar. The tar to be worked is straight run coal-gas tar, obtained at the gas works.

Can you give me the names of contractors thoroughly familiar with the coal tar macadam work, whom I might secure to lay down a street in Dubuque and instruct me as to the proper manner of doing the work?

GEO. McLEAN,
Pres. Key City Gas Co., Dubuque, Ia.

Reference should be made to vol: xxv, p. 202, of Municipal Engineering, for the statement of the city engineer of Duluth, dividing the bituminous macadam pavement into three classes and describing

these classes. Reference may then be made to vol. xxv, p. 253, for the general specifications for coal tar used in various places. The quality of the coal tar is a very important factor in the success of the pavement. An article on "Coal Tar for Paving Uses" in vol. xx, p. 204, goes into some detail regarding the necessary qualities. The methods used in laying the tar macadam pavements at Hamilton, Ont., are described in vol. xx, pp. 296, 323, 370 and vol. xix, pp. 283, 262 and 423.

Mr. F. J. Warren has made a detailed scientific study of the question of bituminous macadam pavements and the results of his labors are described in articles in Municipal Engineering as follows: Vol. xx, p. 262; vol. xxiv, p. 115; vol. xxi, pp. 164, 285. Specifications for laying this pavement in their original form will be found in vol. xxi, p. 40. The development of the present form of the pavement is shown in vol. xxv, p. 99.

These articles and a number of other short descriptions of actual construction scattered through the last four volumes of Municipal Engineering will show the principles upon which the construction should proceed and the difficulties which arise when these principles are departed from. Mr. Warren has undoubtedly developed a successful pavement on which he has secured patents covering the novel features. Attempts have been made to discredit pavements of this class by laying inferior pavements of inferior materials, but without success. Good pavements can be laid by other methods if good materials are used, but engineers who have published reports of their investigations are unanimous in declaring the Warren pavement to be the best, and the best designed of any yet constructed. An article by C. A. Kenyon in this number gives details of the method of construction of the Warren bitulithic pavement.

Reference may be made to the "Business Directory" under the headings, "Bitulithic Pavements," "Bituminous Macadam," "Coal Tar," "Contractors," "Paving Contractors," "Paving Pitch," for sources of material and names of contractors laying the pavements.

## HOW TO KEEP FLAT SEWER CLEAN.

I am about to begin the construction of a lateral sewer about 1,100 feet long of six-inch pipe. The best grade I can get is 0.2 per cent., say 1 in 500. It will, in time, have to serve some fifteen or twenty dwellings and a school of 100 to 200 scholars. The upper fifty feet, which will serve two dwellings, has to be four-inch pipe in order to get under a brick paved street. The proximity of the upper end to the surface, less than two feet, precludes the use of a flush tank in the street. The adjacent yard, some four feet above the street, offers a good location for a flush tank, but the owner is reluctant to allow its use. Would it be prudent to try to use so small a sewer on so flat a grade without automatic flushing? They will use iron pipe for four-inch part, and it is probable that only the school and three or four dwellings will use sewer for several years yet.

J. A. WILSON,
Lexington, Mo.

The sewer cannot be expected to keep itself clean and if arrangement cannot be made for the location of the flush tank there should be plenty of manholes and the sewer should be flushed frequently by hose. The manholes should be at every change in direction of the sewer and at every street intersection. Where the sewer is nearest the surface possibly T's covered by lamphole covers may be sufficient. The automatic flush tank is probably the most satisfactory method of flushing the sewer, though the use of four-inch pipe in the upper end will largely reduce the flushing effect in the larger pipe farther down. It may occasionally be necessary to flush the six-inch pipe lower down through the manholes even if the flush tank is in good working order, on account of the loss of flushing force in the larger sewer. The four-inch pipe might be treated as a house connection, making access to it easy by means of manhole or lamphole and the flush tank put at the beginning of the larger sewer. Although the six-inch pipe is large enough for the use proposed, the writer's observation leads him to prefer eight-inch pipe, with or without the flush tank as much less liable to stoppages.

## NAMES OF MANAGERS OF MUNICIPAL PLANTS.

We wish to obtain the names of the managers, engineers and other officials connected with municipal plants throughout the country, especially water works plants. Do you know of any such list, and if so where it can be obtained?

—PUMP CO., New York.

There is no list of such officials which is kept up to date. The "Manual of American Water Works" ($3) gives names of officials of all water works, whether municipal or private, but its last edition is dated 1897. The "Municipal Year Book" ($3) gives names of superin-

tendents of municipal plants of all sorts and its date is 1902. It lists all cities of 3,000 population or more, and is the nearest what is asked for that is published. Municipal Engineering Company can supply the books at the prices quoted.

## WIDTH OF PAVED ROADWAYS.

The adopted widths of walks, lawns and roadways in the city of Indianapolis, referred to in vol. xxv., p. 172, September, 1903, are as follows:

For north and south streets with car tracks.

| Total width feet. | Walk feet. | Lawn feet. | Roadway feet. |
|---|---|---|---|
| 30 | 5 | .... | 20 |
| 40 | 6 | .... | 28 |
| 50 | 6 | 4 | 30 |
| 60 | 7 | 5.5 | 35 |
| 70 | 8 | 7 | 40 |
| 80 | 9 | 8.5 | 45 |
| 90 | 9 | 11 | 50 |

For north and south streets without car tracks:

| Total width feet. | Walk feet. | Lawn feet. | Roadway feet. |
|---|---|---|---|
| 30 | 5 | .... | 20 |
| 40 | 6 | 2 | 24 |
| 50 | 6 | 7 | 24 |
| 60 | 7 | 8 | 30 |
| 70 | 8 | 12 | 30 |
| 80 | 9 | 13.5 | 35 |
| 90 | 9 | 16 | 40 |

For east and west streets with car tracks:

| Total width feet. | Walk feet. | Lawn feet. | Roadway feet. |
|---|---|---|---|
| 30 | 5 | .... | 20 |
| 40 | 6 | .... | 28 |
| 50 | 6 | 4 | 30 |
| 60 | 7 | 8 | 30 |
| 70 | 8 | 12 | 30 |
| 80 | 9 | 11 | 40 |
| 90 | 9 | 13.5 | 45 |

For east and west streets without car tracks:

| Total width feet. | Walk feet. | Lawn feet. | Roadway feet. |
|---|---|---|---|
| 30 | 5 | .... | 20 |
| 40 | 6 | 2 | 20 |
| 50 | 6 | 7 | 24 |
| 60 | 7 | 9.5 | 27 |
| 70 | 8 | 13 | 28 |
| 80 | 9 | 16 | 30 |
| 90 | 9 | 21 | 30 |

These rules are made to fit the conditions as nearly as general rules can. The north and south streets are in general the main streets and the east and west streets are cross streets. Lawns are omitted on business streets and sometimes part of this space is included in the roadway. The influence of car tracks in determining the width is evident. On residence streets in the older parts of the city the location of shade trees often requires modification of the width by rule.

In making gravel and macadam streets it was formerly the custom to make gutters sloping on each side and often paved with cobblestones, no stone curb being put in, but this form of construction has now been abandoned and stone curb or concrete combined curb and gutter is used. The open gutter without curb is very satisfactory for residence streets with little travel in small towns and cities, but loses its place when metropolitan methods of improvement are adopted.

In an article on Indianapolis pavements elsewhere in this number will be found the statement that during the past two or three years fully three-fourths of the residence streets have been improved 24 feet wide, all being at a distance from the center of the city.

In Norfolk, Va., slightly different standards of width have been adopted, thus a street 40 feet wide has sidewalks 10 feet wide and roadway of 20 feet; fifty-foot streets have 26-foot roadways and 12-foot sidewalks; sixty-foot streets have 32-foot roadways and 14-foot sidewalks. The sidewalk space is divided, about 7 feet being paved and the remainder a strip of lawn. The city engineer has paved some streets of more than sixty feet width with 27-foot roadways, the remainder being sidewalk and lawn of about the proportions above stated.

## HOW TO CLEAN A MOSAIC FLOOR.

We have a new library building with mosaic floors in black and white design. These floors have been thoroughly cleaned with water and soap for several weeks. The colors, however, do not come out clear and strong, but the entire floor is gray and looks as if covered with dust. Will you kindly write us at earliest convenience what treatment is best for this case.

HENRY GLEN,
Librarian, Schnectady, N. Y.

Possibly the cleaning has been with mops, which are liable to leave a thin film of dirt or dust on the tile. Thorough rubbing with brushes ought to improve the appearance of the floor. If it does not the F. E. Gates agency of Indianapolis, practical mosaic floor layers, gives the following prescription:

First rub the floor thoroughly with small flat pieces of sandstone, then take

Gibson's soap polish, made by the Gibson Soap Company of Omaha, Neb., and use according to directions. This is a soap powder made for cleaning floors of all kinds. For tile floors of any kind the space to be cleaned is wet, the soap polish is then sprinkled on lightly and the floor is well scrubbed with a brush and wiped clean. It will then be free from all gummy substance and nothing will be left to retain dust and dirt. The soap also works well under a mop, but the above method is more satisfactory. Doubtless there are other soaps which will give good results and the principal requirements are good scrubbing and thorough removal of the debris.

## SEWER ASSESSMENTS OUTSIDE OF DISTRICT.

A city has made sewer district No. 1 and built sewers therein, and the real estate owners in the district have paid taxes on the sewers for several years. The district is located nearly in the center of the city area, leaving a portion of the city on the east and a portion on the west unsewered. District No. 1, the eastern part and the western part of the city are all three separate, and must have separate outlets.

The eastern part forms sewer district No. 2. Can property in district No. 1 and in the western part of the city be taxed to pay for sewers in district No. 2?

E. COOK, Pine Bluff, Ark.

This is a question for an attorney who knows the laws of Arkansas and the court decisions under them. Many decisions upon sewer assessments have been reported in Municipal Engineering, but none from Arkansas.

The general principle upon which the reported decisions rest is that there must be some benefit derived from the sewer, either present or prospective or an assessment is not valid. The nature of the benefit is not so definitely fixed. In some cases it is impossible to assess a lot for a main sewer unless the branch sewer serving the street on which the lot is located is constructed at the same time. In other cases the payment of a portion of the cost of each sewer by the city at large is even required. Taxpayers outside the sewer district thus receive, through the general tax levy, an assessment for a part of a sewer which only benefits them in that it benefits the city at large. What are the legal requirements in Arkansas is a question somewhat outside the province of this department to give an opinion upon.

The general principles upon which sewer assessments should be based, area, frontage, value, local, district, city shares, etc., have frequently been discussed in this magazine. There are also numerous statements of the methods in vogue in various cities and states. These articles may be of interest and a list of some of the more important follows:

"The Brockton, Mass., plan," vol. vii, p. 82, vol. xii, p. 105 and vol. xxi, p. 174; "The Fall River Plan of Sewer Assessments," vol. xxiii, p. 168; "Sewer Assessments in Different Cities," vol. xii, p. 372; "The Boston Sewer Assessment Plan," vol xvii, p. 33. Discussions of the subject of sewer assessments by the editor in articles and the editorial and question departments will be found in vol. xiii, p. 154; xiv, p. 38; xv, p. 215; xvi, p. 312; xviii, pp. 247 and 252; vol. xxi, p. 82.

## THE PLATINUM WIRE TEST FOR TURBIDITY OF WATER.

Can you tell me where I can get information regarding the way to graduate the scale and the size of the platinum wire used in the platinum wire test for turbidity of water by the silica method?

W. R. SMYTHE,
City Engineer, Canon City, Col.

Hazen's "The Filtration of Public Water Supplies" ($3) has a full description of the method of making platinum wire test of turbidity of water. The assumption upon which it is based is that a water in which a platinum wire 0.04 inch in diameter can be seen at a depth of one inch has a turbidity of 1.00. If the wire can be seen at a depth of 2 inches the turbidity is 0.50, if at a depth of ten inches it is 0.10, etc., being inversely proportioned to the depth at which the wire is seen. The rod which carries the wire is graduated for degrees of turbidity, not for depth. There are many practical difficulties in the application of the apparatus which are fully explained by Mr. Hazen in the book named.

## FRANCHISES FOR SEWER COMPANIES.

Can you tell me of franchises for sewer companies?

M. H. CRUMP,
Bowling Green, Ky.

The question of sewer franchises has been discussed in several articles in Municipal Engineering. The sewer franchise in New Orleans is considered in vol. x, p, 417, and vol. xiii, p. 93, and the decision of the court deciding the franchise to be void is abstracted in vol. xxii,

p. 397. The terms of a franchise for a system in Telluride, Colo., are given in vol. vi, p. 372, and it is understood that Leadville and Cripple Creek passed similar ordinances. In vol. xxii, p. 94, are given the rates charged under the sewer franchises of Atlantic City and Asbury Park, N. J., and on p. 382, is further consideration of the method of conducting a private sewer company with mention of several other towns having partial sewer systems under private control. The general terms of a bill providing for the grant of franchises for sewerage systems in Indiana will be found in vol. xxiv, p. 138. This law was passed so restricted that it applied only to the city of New Albany, and an ordinance proposing to grant such a franchise was introduced in the city council but has not been passed. The legality of such franchises under the general laws of the state of Colorado is denied in a court decision reported in vol. xxiv, p. 201, on a case from Canon City, on the ground that the city had no right to charge rental for the use of a sewer and so it could not delegate this power to a sewer company.

## MAKERS OF STREET GARBAGE RECEPTACLES.

We will greatly appreciate any information as to makers of any form of street garbage receptacle.

AMERICAN LEAGUE FOR CIVIC IMPROVEMENT, Chicago, Ill.

The Iron Clad Manufacturing Co., Brooklyn, N. Y., issues a catalogue of its products, which includes fourteen or fifteen styles of galvanized garbage, ash, stable and street cleaning cans.

The W. J. Clark Co., Salem, O., sends a leaflet illustrating steel shop kegs and barrels which might be used for garbage, and will make any desired form.

The Zenner Disinfectant Co., for the Sanitary Garbage Pail Co., of Detroit, Mich., sends a circular descriptive of a sanitary garbage pail to be set in a fence or wall and filled from one side and emptied from the other.

The Morse Boulger Destructor Co., of New York sends the following list of manufacturers of ash and garbage cans of various designs:

Buhl Stamping Co., Detroit, Mich.

Howard & Morse, 45 Fulton-st., New York.

L. O. Koven & Bro., 50 Cliff-st., New York.

Moseley Iron Bridge and Roof Co., 39 Cortlandt-st., New York.

Steel Basket Co., Cedar Rapids, Ia.

Walter A. Zelnicker, St. Louis, Mo.

The City-Wastes Disposal Co. of New York adds the names of

The Thornton N. Motley Co., 12 John-st., New York.

Robert Frame, Newport, R. I.

Mr. Rudolp Hering says almost any expert tinsmith can make the cans and gives the following general directions: "In localities where the cold weather is not serious, galvanized iron is the best material and in the colder countries wood is preferred. The shape should be narrower at the bottom than at the top, so as to allow ready emptying at all times. They should have covers setting in, so that the garbage is protected against animals and also to be more sightly. The covers should be firmly let in, so that they cannot be easily knocked off."

## HOW TO MAKE A RESERVOIR WATER TIGHT.

Regarding the methods of making reservoir walls water-tight suggested in the October number of Municipal Engineering, vol. xxv, p. 252, the following letter has been received from Mr. Marchant:

"The schemes which you suggest we had thought of, but do not believe that the cement will turn the water under the pressure existing. We had also thought of a device of building a 4-inch brick wall inside of the present brick wall, leaving a space between of 2 or 3 inches, and pouring this space full of asphalt. We do not think that there is any doubt that this will make the side walls perfectly water tight, provided it was done carefully so that no voids may occur in the asphalt.

"We also thought of making the bottom tight by repairing the cement bottom, which was burst by the outside pressure, and laying over this a layer of 3-ply tarred roofing properly lapped and jointed with asphalt, and then lay over the tarred roofing a layer of about 2 inches of asphalt, over which will be constructed a concrete bottom to hold the asphalt in place.

"In constructing the concrete bottom we thought of using the inverted dome shape with steel bars or metal lathing to strengthen same, and in order to keep the water down while the work was in progress, to have a small basin in the reservoir so arranged that all water as it rises will drain into this basin, out of which the water will be pumped as fast as it rises. In order to close this after we

had completed the work, we proposed to build in the bottom as the asphalt and concrete was laid, a short section of wrought iron pipe arranged with flanges on the outside so that the cement would hold fast to same, and so that it could not be easily turned after the cement had set; this pipe to be arranged so that a cap could be screwed on the head of same and thus make it water-tight.

"We believe that this method will remedy the trouble which we have been having, but it is rather an expensive method, and we thought perhaps through your magazine we might get some ideas which would be equally as good, if not better, at a low cost."

The methods suggested on page 252 are less expensive than those above suggested and with proper design, workmanship and materials should be equally satisfactory. If asphalt is used, some variety which is not injured by water should be chosen.

Can our readers suggest other cheap and effective methods of solving our correspondent's problem?

### WATER MAINS IN STREETS OR ALLEYS.

Will you inform me in the Magazine where in your opinion is the proper location for water service mains—in the streets or alleys? Local conditions, of course, regulate this to a certain extent. But where streets and alleys run parallel it occurs to the writer that the tearing up of streets could be saved. Twenty-foot alleys are wide enough for water, sewer and light and telephone conduits or poles.

SUBSCRIBER.
Great Falls, Mont.

Alleys are often the best locations for water mains for domestic service, the service lines to houses being no longer, if as long, and the tearing up of paved streets is prevented. One objection is that there is not the regularity in location of alleys that there is of streets, but this need not prevent the use of the alleys whenever it is possible. It is customary to put fire hydrants on street corners but the same length of hose from hydrants located at the middle of a block will cover the block better than from hydrants at the corners. Twenty-foot alleys are not common nor are they often desirable, and the water pipes and conduits do not demand them. Sewers on the separate system can be put in the alleys with the other pipes, being so far below them, but it is probably not economical to put combined sewers in the alleys, since catch basins must ordinarily be at street corners. Unfortunately the irregularity of alleys in most city plats prevents their general use for these purposes.

# THE LEAGUE OF AMERICAN MUNICIPALITIES

**Convention Report—Winnipeg Municipal Asphalt Plant—Municipal Statistics.**

### Convention of the League of American Municipalities.

The seventh annual convention of the League of American Municipalities was held at Baltimore, Md., October 7, 8 and 9. "The Advantages of Municipal Construction Over the Contract System" was the subject of a paper presented by James M. Head, mayor of Nashville, Tenn., who favored municipal construction of sewers, paving and other public utilities, and objected to the contract system, claiming that it had done more to corrupt public officials and lower the standard of official integrity than any other one cause save the granting of franchises to quasi-public corporations. He thought the only public remedy to improve conditions under the contract system is to abolish the rule requiring the acceptance of the lowest bid and placing public officials upon their honor and imposing upon them the responsibility of doing what is best for the city and then holding them to a strict accountability for the results obtained. Lou's W. Anderson, city engineer of Grand Rapids, Mich., and Henry Bell of Columbus, O., followed this paper in a discussion, each claiming that the contract system had obtained better results at less expense than the day labor plan. Ignatius Sullivan,

mayor of Hartford, Conn., favored municipal construction, even at greater cost, because the city can then be sure that the work will at least be done well, a thing impossible under the contract system. Prof. Frank Parsons thought it was unfair to compare the worst results under one system with the best results under another. ' Representative examples should be chosen for each side. He favored municipal construction, however, and believed that under private contract the motive is private gain; under direct municipal construction the motive is public service. The Hon. Samuel Jones, mayor of Toledo, O., thought that to say a corporation will do better work than a city is to say that a part of the city is better than the whole; that the true solution of all such problems is to have civic patriotism rise above party issues.

Other papers presented were: "Water Waste," read by E. W. Bemis, superintendent of water works at Cleveland, O.; "Garbage and Sewage Disposal," Rudolph Hering, M. Am. Soc. C. E. of New York City; "Municipal Statistics," Hugo S. Grosser, Municipal Statistician and Librarian, Chicago, Ill.; "Municipal Telephones," John F. Hemenway, New York City; "Organized Labor and the Municipality," Ignatius Sullivan, mayor of Hartford. A. W. Dow, inspector of asphalts and cements, Washington, D. C., was unable to be present, but forwarded his paper on "Paving." In a paper on "The Operation of a Municipal Asphalt Plant," the Hon. John Arbuthnot, mayor of Winnipeg, Manitoba, described the operation of a plant at Winnipeg for the years 1899 and 1900. Abstracts of two of these papers follow and others will appear in an early number of Municipal Engineering.

## The Operation of a Municipal Asphalt Plant.

Mayor John Arbuthnot gave the following statistics regarding the operation of Winnipeg's municipal asphalt plant in his paper before the League of American Municipalities:

The first asphalt was laid in Winnipeg in 1897 by local contractors at $2.35 per square yard. The specifications were based on the use of Trinidad lake asphalt and the contractors found it difficult to procure that kind until they secured permission to use other kinds.

In the following year the same contractors received $2.75 per square yard and there was considerable trouble in having the work done in accordance with the specifications. In 1898 the city engineer was instructed to make an estimate of the cost of the work by city labor, and bids were also received from contractors. After a struggle the day labor advocates finally won out. The plant of the local company was purchased and erected on leased ground. When the city came to execute the paving it was found that the threat as to preventing its procuring asphalt had not been idle, it being impossible to obtain prices on any of the standard eastern asphalts. After careful investigation a contract was made for a supply of Ventura asphalt, and with such expert assistance as could be obtained this asphalt was laid on Portage-ave.

At first the mistake was made of trying to make a good surface with from 7 per cent. to 8 per cent. of bitumen. It was seen that this was not satisfactory and the work was taken up and relaid, the bitumen being increased to from 10 per cent. to 11 per cent. This asphalt has been down now for over five years and is in almost perfect condition.

The quantities of asphalt laid in Winnipeg are as follows:

| | Square yards. |
|---|---|
| 1897—By contract | 7,314 |
| 1898—By contract | 4,009 |
| 1899—By day labor | 45,843 |
| 1900—By day labor | 22,195 |
| 1901—By day labor | 51,624 |
| 1902—By day labor | 82,404 |
| 1903—By day labor | 70,000 |
| Total | 283,389 |

The kinds of asphalt used have been: Ventura, Alcatraz (small quantity), Obispo, Acme, Los Angeles, Trinidad Lake, Trinidad Land, Venezuela, Bermudez:

The least successful has been the Trinidad Land asphalt, although this was laid under the direction of the parties from whom the asphalt was purchased. Some of this asphalt was laid successfully by mixing it with California asphalt.

The repairs to asphalt pavements have, apart from settlement over pipe trenches and street railroad work, been trifling. The amount for each year is as follows: 1899, nil.; 1900, nil.; 1901, $241.31; 1902, $47.89; 1903, $64.00.

Accounts of the construction and operation of the plant, including cost, will be found in Municipal Engineering, vol. xx, p. 358, and vol. xxii, pp. 144 and 176. The total value of the plant in 1903 is $17,399, including 5 per cent. allowance for depreciation. The maintenance, operation and capital charges are as follows:

1899, $2,027; 1900, $1,970; 1901, $2,712; 1902, $4,610.58; total, $11,319.58.

The average force employed in laying the pavement costs $59.90 a day.

The prices of materials in Winnipeg are: Sand, per cubic yard, $1.25; broken stone, $1.10; cut stone curb, per lin. ft., 90 cents; artificial stone curb and gutter, lin. ft., 65 cents; cement, per 100 lbs. 1903, 85 cents; wood, per cord, $5; coal, per ton, bituminous, $6 to $8.

The appropriate composition and cost of the binder and surface mixture is as follows:

| Binder— | |
|---|---|
| Limestone, 900 lbs | $ .40 |
| Asphaltic cement, 35 lbs. at 1½c | .52½ |
| Fuel | .15 |
| Labor | .22 |
| | $1.29½ |

At 7 square yards per batch, cost per square yard is $0.18½, capital and plant charges, etc., not included.

| Asphalt—Bermudez, at $30.00 per ton— | |
|---|---|
| 900 lbs. sand, .4 cubic yds. at $1.35 | $ .54 |
| 140 lbs. dust, ⅛c | .18 |
| Fuel | .12 |
| Labor | .32 |
| Oil, 23 lbs. at 1½c | .34 |
| Asphaltic cement, 117 lbs. | |
| 100½ lbs. Asphalt (gross wt.) at 1½c | 1.50 |
| | $3.00 |

At 174 lbs. per square yard, 6.6 sq. yards, cost per square yard, .45½c.

| California Asphalt, at $25.00 per ton— | |
|---|---|
| 900 lbs. sand, 46 cubic yds, at $1.35 | $ .54 |
| 85 lbs. dust, ⅛c | .11 |
| Fuel | .12 |
| Labor | .32 |
| 120 lbs. Asphaltic cement. | |
| 39 lbs. Liq. Asphalt, 1½c ($0.58½) | |
| 90 lbs. Los. Ang., 1¼c (1.23½) | |
| 3 lbs. Oil, 1½c (.04½) | 1.75½ |
| | $2.84 |

At 175 lbs. per square yard, 6.6 sq. yards, cost per square yard, .43c.

The cost of asphalt as charged to the property-owners is approximately as follows:

| | Per Square Yard. |
|---|---|
| Grading | $ .15 |
| Sand ballast | .15 |
| Concrete, 4½ inches | .67½ |
| Binder, 1½ inches at plant | .18½ |
| Binder labor on street | .08 |
| Surface, 1¾ inches at plant | .45 |
| Surface labor on street, teaming, etc. | .15 |
| Plant charges | .05 |
| Miscellaneous charges | .03 |
| Engineering and collection charges, 6 per cent. | .11 |
| Maintenance charges | .25 |
| Total charge to property-owners | $2.28 |

## Bureau of Municipal Statistics.

The following are some extracts from the paper by Hugo S. Grosser, municipal statistician and librarian of Chicago, on the subject of "Municipal Statistics:"

Let there be in every city a statistical bureau established upon a uniform basis, and exchanging with each other the results of their investigations, and you will have created a powerful stimulus to progressive municipal government, because the exact knowledge of conditions elsewhere will be a potent inducement for us to at least strive to excel.

The statistical department of Boston was established in 1897, in charge of a board of six members, whose secretary is Dr. Edward M. Hartwell. In 1896 Dr. Hartwell, on the request of the then mayor, the Hon. Josiah Quincy, visited the leading municipal statistical offices of Europe. In his report to the mayor he says:

"It is possible for a well conducted municipal statistical office to render most valuable assistance to the heads of all departments of city affairs, as well as to enable the chief magistrate of cities to acquire ready and accurate information upon a great number of subjects of vital importance. * * * In the sphere of municipal administration such offices serve much the same purpose as does the headquarters staff in the administration of modern military affairs; that is to say, being organized as intelligence departments they furnish the executive department of the city government with such information as it requires for devising and conducting its plan of campaign against ignorance, disease, crime, pauperism and extravagance. Through their publications such offices are also capable of rendering important aid to the electorate in arriving at intelligent conclusions as to the degree of fidelity and efficiency shown by its public servants in the discharge of their duties."

The second municipal statistical bureau, still in existence, was established in Chicago in 1901 and is now in its third year. In 1900 a small sum was appropriated by the city council of Chicago for the establishment of a so-called "Municiapl Library," the purpose of which was the "collecting and collating of pamphlets, reports and works on municipal matters and a study of systems in vogue in other cities."

Mayor Carter H. Harrison has said that "the expectations which were entertained of the library have been more than fulfilled."

A third bureau of municipal statistics

was established last year in the city of Baltimore, and I have no doubt but that its work has gained the full appreciation of the administration and the enlightened citizens of this progressive community. A similar department had been created in New York under the new charter of 1897, but was abolished again under the amended charter of 1901.

From information received by me from mayors and others, I learn that the establishment of municipal statistical bureaus is contemplated by several other cities, and I sincerely hope that ere many years such a department will have become a permanent fixture in every city of our land.

The value of such an office can hardly be overestimated. It serves, so to speak, as a clearing house for information on municipal topics. It is visited, at least in Chicago, by city officials and business men by students and teachers, by professionals and even by politicians, who have learned that they can find there already prepared, or upon short research the information for which, prior to the existence of the bureau, they had to search in a great variety of documents, if they were lucky enough to find these anywhere at all.

The Chicago office contains today a library of more than 6,000 volumes, comprising the charters, ordinances, reports and documents of more than two hundred cities from all parts of the world, and it has become sufficiently known to be today the chief center for municipal research in that city.

Aside from serving as a bureau of information, the influence of a municipal statistical office will make itself felt in every single department of the municipality. The mere knowledge of its existence will be conducive to greater accuracy in the accounts and reports of each branch of the municipal government and to the utmost carefulness of every city employe; because if it is known that the work of each department is recorded and published each month, and that these reports are preserved and can at all times be referred to and compared with, it seems but natural that each department will avoid any slip-shod methods and will endeavor to keep up its records. This has been my experience in Chicago. There each department and bureau, as far as embraced within the scope of the statistical office, at the end of each month reports in detail the work performed, together with its cost; and while in the beginning I often had occasion to call the attention of various officials to faulty figures and careless accounts, this is today a very rare occurrence, and the annual reports of the various departments will exactly tally with the monthly returns recorded in the statistical bureau. In some cases it was necessary to appeal to the head of the department, rarely to still higher authority, but this always led to an improvement or even an entire change of methods and to the achievement of the results desired.

Of course, this end can be attained only if the Bureau has the fullest backing of the chief executive. The work of the statistics office must be done without fear or favor, without regard to political influence, and with the sole endeavor to present nothing but pure, unadulterated facts. It must be done scientifically and to bring about the best results, and it is desirable that at least the chief statistician should have scientific training. He must be an enthusiastic and tireless worker, or else the municipal statistical bureau is bound to be a failure.

# CURRENT INFORMATION

**Chicago Markets and Work—New York Water Supply—Detroit Grand Jury —Philadelphia Asphalt—San Francisco Street Railway—Water Pipe Right of Way—Banquet in Sewer—Technical Meetings—Personal Notes.**

## Chicago Markets and Work.

The cement market here continues in the same unsettled state it assumed early in the summer. Prices are ranging from $1.35 to $1.65 with very little demand. Within the month a consignment of 10,000 barrrels was offered a Chicago jobber at a price that would have permitted the marketing of the stuff with a good profit at $1.25. The offer was not accepted, however. There is little or no new business at the present time, and what stock is com-

ing into the market is on old contracts, work on which is being rushed to finish up before the bad weather sets in. It is thought the unfavorable conditions in building and contracting lines the past season will be largely changed before another building season opens up, and hence there is a hopeful condition prevailing among all lines interested in the business, but such high prices as prevailed last year are not looked for again.

The brick business for the season is reported well ahead of last year's operations, provided conditions as existing at present are maintained to the end of the year. There is a slight falling off since the first of August, but it is not thought sufficient to have overcome the big spring and summer business. The prices have been lower throughout the season than last year and the tendency is still downward.

The action of the board of education in paving all Chicago public school yards made a good feeling among the paving brick people. Some thirty or forty of the school yards have been paved during the summer and fall and the results are so satisfactory that the work will be taken up again in the spring and finished as rapidly as conditions will permit. The market for building and contracting specialties is light with very little demand for factory work. Residence and flat building has been almost at a standstill for a long time and the only work undertaken has been the necessary building for strictly business purposes.

Stone dealers report prices close and competition keen but the outlook is regarded as very satisfactory for the most part.

In paving work the demand for asphalt shows a constantly increasing tendency. While the condition of the cement market has more or less unsettled prices the amount of work to be done in this line is so great that the asphalt people are feeling very contented with conditions and the outlook.

Very little wooden paving is being done in Chicago except some cedar blocks for private work on a small scale and some public experimenting with the creosoted block.

On the last letting of contracts by the board of local improvements the principal subject of interest was the Milwaukee-ave. paving. The bid had been readvertised as a result of charges of high rates and when the new bids were opened it was found the Citizens's Construction Company had put in the lowest offer. This was $64 872 for the contract, whereas the previous bid which was rejected was for $67,009. Shackley & Co., who were the lowest bidders in the first instance, did not change their figure on the readvertisement, but stood on the basis of $4 32 per equare yard for the granite blocks specified. The Citizens' Company bid was on the basis of $4 19.

The wide tire ordinance has been signed by the mayor and will become a law on Jan. 1, 1906. It is estimated that compliance therewith will cost the Chicago team owners from $2.000,000 to $3.000.000. Owing to the labor and expense involved in the matter the teamsters are given a long time to comply with the law. It will ultimately make a saving of approximately $1,000,000 a year in maintenance of pavements.

The city engineer's office has well under way the work of remodeling the Chicago-ave. pumping station. The engines that were installed in 1853, 1857, 1869 and 1892, respectively, are being taken out and replaced with three Allis-Chalmers engines, at a cost of $290,000. The whole work will cover a period of a year and a half. It also includes a remodeling of the tunnel system around the station at a cost of $500,000. The contract for the tunnels was let to John J. O'Brien & Co. The William E. McCarthy Co. is building the foundations for the new engines at approximately $22,000. In connection with the work a new twenty-ton traveling crane has been installed in the plant by the Whiting Foundry and Equipment Co., at a cost of $150 000.

In the near future the office will let contracts for the new boiler plant at the Fourteenth-st pumping station. This will include six horizontal return tubular boilers, full conveying plant, to take the place of nine ordinary tubular boilers that have been in service for twelve years. Each of the new boilers is to be 250 horse-power with a pressure of 150 pounds. It is estimated that the cost will be approximately $100 000.

The city engineer is also making plans for the extension of the three water tunnels from the Chicago-ave. station to the two-mile crib. These will be consolidated into one eleven-foot tunnel and extended 4,200 feet, to the Carter H. Harrison crib and the old two mile crib abandoned. The cost of the work is estimated at $210,000. The pumping plant in connection with the new intercepting sewer will be temporarily in service this fall, although the final installation will not be ready before spring. A similar work on the North Side is held up pending a decision by the courts as to whether the municipality has

the right to do the work by day labor. The bids on the contract were not satisfactory and as, owing to the failure of the contractor on the Thirtieth-st. work, the city had undertaken the work there without opposition, they intended to do the same on the North Side, when an injunction was interposed and the case is still in the courts.

The contracts for four sections of the Chicago drainage canal extension at Lockport, Ill., by the sanitary district trustees, amounting to nearly $2,000,000, have been awarded to Joseph J. Duffy and the Lorimer, Gallagher & Walsh Construction Company.

Following an investigation by the improvement board, Mayor Harrison, basing his declaration on other corroborative information secured by him, asserts that there exists a national paving combination which controls all public work in the various cities and fixes the prices for material, work and labor He suggests as a remedy that the legislature amend the special assessment law to permit the city to go into the paving business by day labor.

During the current year the contracts made by the city of Chicago for the paving of streets will amount to between $3,500,000 and $4,000,000, including fully 135 miles of streets of which about eighty-five miles will be laid this year. At the present time the demand of property owners for street paving far exceeds the ability of the contractors to comply, as they have more work now than they can do.

After November 1, the collection of refuse in at least seven of the most populous wards will have to be suspended owing to the lack of funds to pay for the work. Relief is proposed in a plan to be submitted to the council to turn the garbage collection of the city over to a contractor for reduction, the money spent by the city under the present system being ample to carry out the contract and reduction plan.

A contract has been awarded the Republic Chemical and Creosoting Company of Indianapolis for paving Taylor-st. with their blocks at $32,000.

The Barber Asphalt Company has been awarded the contract for resurfacing West Madison-st. for $42,114, as against $46,000, the next bid.

The R. F. Conway Company are working to earn a bonus of $20,000 on their contract for paving Forty-third-st. from Halstead to State. They secured the contract from the city on the basis of $59.015, and the property owners were so anxious to have the paving work expedited that they have offered the company the bonus stated provided the asphalting is finished by Dec. 31. On the last letting the Conway Company was the lowest bidders on the Chestnut-st. paving at $9,750, and Monroe-st at $14,401. The Barber Asphalt Company was the lowest on Archer-ave. at $79,386, on Thirty-fifth-st. at $11,456, on North Clark-st. at $9,323, and on Thirty-first-st. at $41,336. Another letting was the Bradley-st. contract to the Citizens Construction Company at $8,395.

The agitation for the paving of Chicago-ave. with asphalt has been taken up by the Ward Improvement Club, the work to be done in the spring.

C. B. MAUGHAM.

## New Water Supply for New York.

In its report to the board of estimates and apportionment of New York City the committee on additional water supply, consisting of William H. Burr, Rudolph Hering and John R. Freeman, state that the preliminary estimates indicate that the expenditure for the first instalment of the increased supply will not be far from $50,000,000. The commission finds that it is possible to obtain a supply capable of development to 500,000,000 gallons per day from streams lying within New York state, viz., the Fishkill, the Wappinger and the Upper Roeliff Jansen Kill; or from portions of these streams and from the headwaters of the Esopus creek in the Catskills or from the Hudson river six miles above Poughkeepsie, near Hyde Park. While all other sources have been considered, none possess the advantages of the above named. The commission points out that each of these sources involves some special difficulty, and each has some advantage in location, quality or expense. The preliminary estimates show no great difference in total cost.

## Detroit Grand Jury Report.

A grand jury which passed out of existence at Detroit, Mich., Oct. 2, made a report to the court consisting of twelve pages of typewritten matter, in which the jurors made comments and recommendations on city affairs as follows:

Political bosses are iniquitous, the ripper D. P. W. act of the legislature should be dissolved and another should be called.

The bookkeeping system of the department of public works is inadequate and in some respects utterly reprehensible as a business proposition. The system should be made to conform with those of the city controller and treasurer.

There should be a property clerk to have charge of the city property in the storage yards of the department of public works.

The custody of the permit fund should be transferred to the city treasurer.

The city accountant's office and work are absolutely misleading under present condition. The office should be filled by a chief with competent and sufficient assistants.

The method of approval of vouchers and pay rolls by the council is misleading. Affidavits to vouchers are administered and taken indifferently and as a matter of form routine. They are so arranged as to be useless in case of attempt at fraud.

The use of rubber stamps for signatures is reprehensible and should be abolished.

Natural cement as a base for concrete foundations is condemned. Detroit has been a dumping ground for inferior paving material.

Street sweeping should be done by the mile instead of by the hour if it is to be done at all by the contract system.

Political assessments should be made illegal and any officer who accepts presents from his employers should be disqualified for office, deemed guilty of a misdemeanor and such action should be sufficient cause for impeachment.

Foremen and superintendents should not be obliged to give work to laborers sent to them by aldermen and politicians.

The fiscal year should be started earlier than July 1.

## Free Competition in Asphalt Repairs in Philadelphia.

The highway committee of the council of Philadelphia, Pa., struck from the schedule of estimates for 1904, Sept. 28, the proviso that only Trinidad Lake or Bermudez Lake sheet asphalt should be used in repairing. Mayor Weaver approved the action.

## Vote Against Municipal Street Railway in San Francisco.

The proposition to issue $710,000 bonds wherewith to take over the Geary Street Cable Company was defeated by more than 6,000 votes, October 8, at San Francisco, Cal. The Geary Company's franchise lapses in a short time, and as the service has been inadequate, the suggestion that the city buy and operate the line met with great favor. The Geary line is a cable road of double tracks, with its own power house, and is two miles in length. It runs from Newspaper Corner, Market and Third, Kearney and Geary to Golden Gate Park by way of Geary-st. and Point Lobos-ave. As it has no franchise for the few blocks beyond Newspaper Corner to the Ferry and on the other end lacks half a mile of reaching the beach, it is greatly handicapped. It is a "middle" line and transfers to the ferry. The plan by which the city was to take over the road included the installation of a modern rapid electric line, with modern appliances for convenience of passengers, and the time for the run to the park was to be cut in half. The opposition to the bond issue was led by Horace G. Platt, president of the Geary-st. road.

## Right-of-Way for Private Water Pipes Granted in Rochester, N. Y.

A decision was handed down by the court of appeals, Oct. 6, in the litigation between the city of Rochester, N. Y., and the Rochester and Lake Ontario Water Company. The decision is in favor of the private corporation, which seeks to supply water to Rochester manufacturers in competition with the municipal system. The Rochester & Lake Ontario Water Company may lay its pipes through the city streets despite ordinances under the White charter and two legislative acts which were passed to defeat its plans. Justice Nash first granted the company a temporary injunction restraining the city from interfering with the work of laying pipes in the city. This injunction was made permanent April 2. On May 26 the Appellate division affirmed Justice Nash's ruling, and now the court of appeals, before which the case was argued June 12, affirms that of the Appellate division. Corporation Counsel Sutherland argued that the company wanted to get a foothold in the city to compete with the municipal system. Albert H. Harris, counsel for the company, replied that when such complications arose the city had its remedy and that the contention was not a part of the case. It was simply a question as to whether or not the company had a right to lay its pipes through the city in order to reach the town of Brighton, where it had contracts to furnish that village and several manufacturers. This contention of Mr. Harris is upheld by the court of appeals.

## Banquet in a Sewer.

A banquet in the Dry Run sewer was tendered the League of Iowa Municipalities Oct. 14 by the city officials and citizens of Waterloo, Ia. The sewer is an immense concrete storm drain, built to protect the city from floods from the

water shed in the west. The arched drain is twenty-two feet below the surface of the earth and is in the shape of a letter "D" lying on its flat side. A table 350 feet in length was spread in the center of the arch and 150 mayors of Iowa cities and 200 of the leading business men of Waterloo were seated at it. The speakers were stationed at the ends of the tables and could be distinctly heard by all. Dry Run sewer is 3,585 feet long, twelve feet wide and twelve feet high. Over 6,000,000 pounds of cement were used in its construction and the greater part of the excavation was made through solid rock. Its entire length is through a populous portion of the city.

## Technical Meetings.

At a meeting of the Electric club, Cleveland, O., Oct. 7, a lecture on "Municipal Ownership" was delivered by H. J. Newcomb of Washington, D. C. He described municipal ownership in general as an unmitigated evil and particularly condemned the proposal to establish a lighting plant in Cleveland under the control of the city.

The sixth annual convention of the League of California Municipalities will be held in Stockton, Cal., Dec. 9, 10 and 11.

The eighteenth annual convention of the National Brick Manufacturers' association will be held at Cincinnati, O., Feb. 1 to 13, 1904.

At the meeting of the Franklin Institute, Philadelphia, held Oct. 21, Mr. John W. Hill, chief engineer, bureau of filtration, gave a full account of the Belmont filters of the new Philadelphia water purification system, which was elaborately illustrated.

## Personal Notes.

A. Shirley has been re-elected borough engineer at Warren, Pa.

Robert P. Howell has been elected city engineer at Phillipsburg, Pa.

John B. Heim has been re-elected superintendent of water works at Madison Wis.

W. J. Parks has been re-elected city engineer for the ensuing year at Bessemer, Ala.

James G. Lee has been appointed assistant civil engineer to the sewerage and water board at New Orleans, La.

Charles Hiscock, superintendent of the board of supervisors, Syracuse, N. Y., died Oct. 22, aged seventy-three years.

Ernest McCullough has been appointed engineer for the Municipal Engineering and Contracting Company of Chicago, Ill.

C. W. Swearingen, formerly city engineer at Great Falls, Mont., has been appointed city engineer at Havre, Mont.

Joseph L. Wickes, formerly assistant engineer in the city engineer's department at Baltimore, Md., has been appointed commissioner of street cleaning.

James A. Lee has been appointed assistant civil engineer on the staff of the New Orleans sewerage and water board.

Charles Hermany has been re-elected chief engineer and superintendent of the Louisville Water Company, Louisville, Ky.

James W. Deacon has been appointed superintendent and treasurer of the Mt. Holly Water Company at Mt. Holly, N. J.

William P. Jackson of Columbus, O., has been appointed general superintendent of the street railway system at Bay City, Mich.

Edward H. Broome has been appointed chief engineer of the water department at Camden, N. J., to succeed L. E. Farnham, resigned.

Henry Santee, superintendent of the works of the Nazareth Cement Co., Nazareth, Pa., died Sept. 27, aged twenty-nine years, of typhoid fever.

John W. Holtzman was elected mayor, Oct. 13, at Indianapolis, Ind., to succeed Charles A. Bookwalter. B. J. T. Jeup has been appointed city engineer.

Dr. Joseph Hyde Pratt of the Engineering Company of America has been in Washington, D. C., on business connected with the United States geological survey.

E. H. Bowser has been appointed general manager of the Southern Creosoting Company, Lt., at Slidell, La., to succeed C. B. Lowry, who resigned to engage in other business.

C. G. Hubbel of the Charlotte office of the Engineering Company of America, who has been in the North looking after some municipal water work for the company, has returned to the Southern office.

Charles L. Welch, C. E., who has done considerable work for the city of Chicago as well as in independent lines, has become associated with the Engineering Company of America in their Chicago office.

Frederick P. Stearns, M. Am. Soc. C. E., has been retained as consulting engineer of the Charles River Basin Commission, Boston. Henry S. Prichett, chairman of the commission sailed for Europe Oct. 5, for a four-weeks' visit.

N. S. Frost, city engineer at Petaluma, Cal., has been appointed town engineer of Sebastopol, sixteen miles north of Petaluma. Mr. Frost has also been appointed secretary of the Board of Helath and ex-officio health officer at Petaluma.

F. D. Weeks, who has charge of the smelting department of the Engineering Company of America, has gone to Copper Cliff, Ontario. He was accompanied by Mr. Edward Everett, who goes as his assistant. The Engineering Company of America has charge of the design, plans and specifications of the new smelter

which the Canadian Copper Company is erecting at Copper Cliff.

Professor Charles E. Greene, dean of the engineering department of the University of Michigan, Ann Arbor, Mich., died suddenly of paralysis, October 16, aged sixty years. Professor Greene was the author of a book on "Graphic Method of Determining Strain and Stress," which revolutionized bridge building, and it was adopted as a text book in European universities.

William Johnson Gillette, Syracuse, N. Y., one of the first promoters of the asphaltum industry, was killed at Buffalo, Oct. 21, by the falling of a portion of the old Grand Trunk freight station. Mr. Gillette had the contract for erecting a new freight station for the New York Central railroad, and was engaged in supervising the demolition of the old station when, without warning, part of the roof fell to the ground, crushing the life out of Mr. Gillette.

Henry E. Knox, jr., southern manager at Charlotte, North Carolina, for the Engineering Company of America, has been at the offices of the company in New York for several days in consultation in regard to work in the South. Mr. Knox makes a specialty of artesian wells and sub-surface water supply. The company, under the direction of Mr. Knox, has just completed installation of a water works system for the Belton Mills at Belton, South Carolina. Similar plants are to be constructed by the company at Anderson and Greenville, South Carolina.

Robert L. Johnson, M. Am. Soc. C. E., superintendent of public works at Columbus, Ga., was killed by a cave-in of a trench on Sept. 30. Mr. Johnson was born in 1865 and was a graduate of the civil enginering department of the University of Georgia in 1887. He was one of the leading municipal engineers in the South, and made a specialty of street and sewerage work. It was while making notes in the bottom of a trench, which suddenly caved in, that he was struck on the head by a mass of hard dirt and killed instantly.

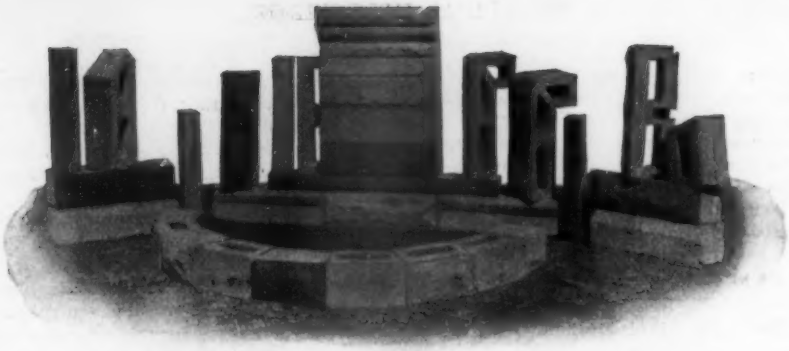
# MACHINERY AND TRADE

## Hollow Concrete Building Block Construction.

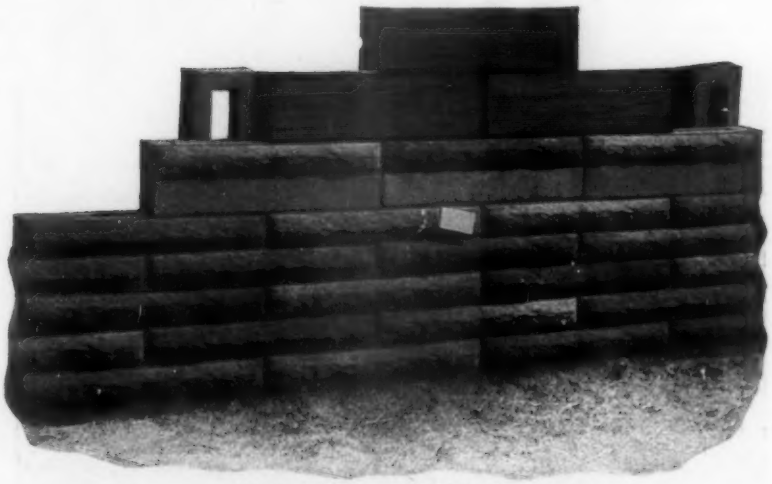
The rapid extension in the use of hollow concrete building blocks is realized by none who are not connected with the business. The numerous machines now on the market, as shown by our advertising columns and the large sales reported by most of them, are evidence of the favor with which this method of construction is received, and the continued growth of the business is evidence that the value of the material is equal to its reputation. By the courtesy of A. D. Mackay & Co., of Chicago, we present some pictures showing some of the forms which the blocks take. The first cut shows a large number of forms of plain blocks, corner blocks, radial blocks, cornices, etc. The second shows a wall made with blocks 10 by 32 inches and 5 inches high, with some special forms on top. The third cut shows a wall of blocks 9 inches high, with cornice and string courses, plain and rock face. This cut, by a typographical error on page 288 of our October number, was said to show Normandin blocks, but are quite different in style and appearance from them.

Two other cuts show the Winget machine, which makes the blocks pictured in the other cuts, one with the mould ready for tamping, the other showing the manner in which the wing plates release the block automatically, also the method of placing the lifter under the supporting bed plate by which the block is carried away to be "cured."

The general process of making a block includes the selection of proper sand or gravel or sand and broken stone, the mixture with cement in approximate proportions of 1 cement to 5 sand, or 1 cement 3 sand and 5 broken stone, the mixture being made dry and then dampened sufficiently to cause it to stick together. If a fine face finish is desired, the rocking feature of the Winget machine comes in good play, as a facing, for example, of 1 cement and 2 granite waste can be put in its proper place and the remainder of the block made of cheaper materials of sufficient strength. The concrete is tamped in and the blocks are removed from the machine on the offbearing plates and set



Various Forms of Blocks.



Wall of Blocks, 5x10x32 Inches.

Wall of Blocks, 9x10x32 Inches.

WINGET HOLLOW CONCRETE BLOCKS.

aside for curing, being watered two or three times a day for the first four days, beginning about four hours after the block is made. The machine has adjustments for height, length and width of blocks and cores and for forms of face and ends. A. D. Mackay & Co., 404 Chamber of Commerce, Chicago, will answer any inquiries about the machine and its products.

### A Concrete Steel Highway Bridge.

The accompanying photograph shows a modern type of short span highway bridge in concrete-steel at Olena, O., built by the American Arch and Culvert Company of Toledo, O. By the use of their patent steel centering the usual wooden false work is done away with and the steel remains as a permanent part of the construction, affording a reliable and economical arch for smaller spans, being practically a metal and concrete arch combined, with the steel reinforcing uniformly distributed.

CONCRETE-STEEL BRIDGE AT OLENA, O.

### A Machine for Making Sidewalk Blocks.

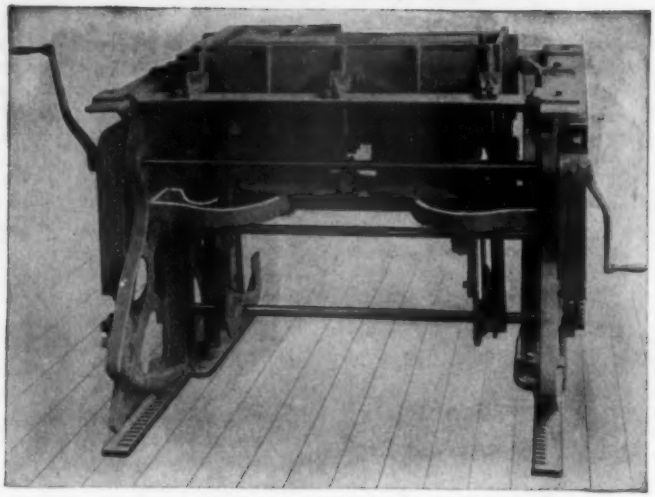
In England most cement sidewalks are made of blocks constructed in machines and laid as other stone blocks are laid. This method of constructing artificial stone sidewalks has not yet been known to any extent in this country, perhaps because none of the machines have been placed on the general market. There are some advantages in making the blocks in a machine and curing them before laying, such as cheapness, better quality, greater ease of repair, less danger from expansion, etc.

A machine is now on the market which will enable contractors to continue their work through the winter as well as the summer, collecting stocks of blocks ready for laying at a convenient season. It is known as the "Samson concrete block machine," and is made by G. D. Rowell & Son of Appleton, Wis. A picture of the machine will be found in their advertisement in this number of Municipal Engineering. Blocks of any size up to 24 inches square and 4 inches thick can be made on a standard machine, and there are machines for blocks up to 20 inches square also. It is said that two men with one machine can make from 90 to 120 blocks a day and three men with two machines can make 200 to 230 blocks a day, according to the size of blocks.

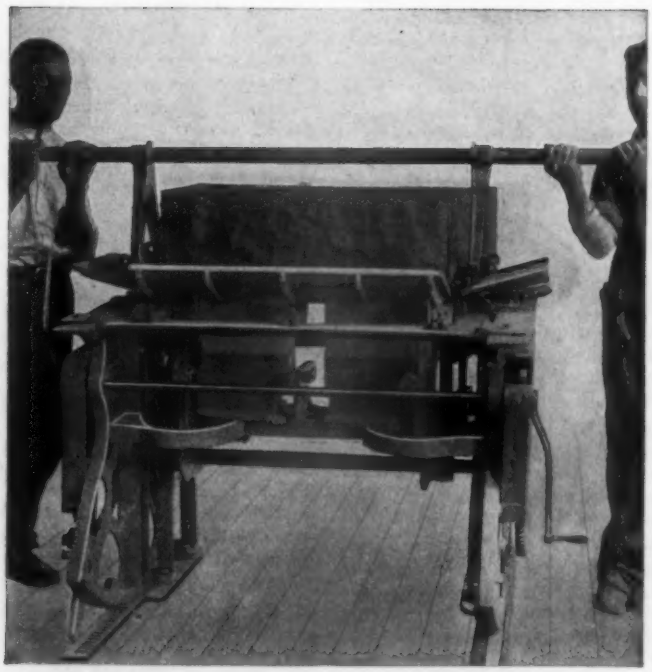
This is an advance in methods of sidewalk construction which it will be worth the while of our interested readers to investigate.

### Gravity Concrete Mixer for Street Work.

The new catalogue No. 12 of the Contractors' Plant Company of Boston,



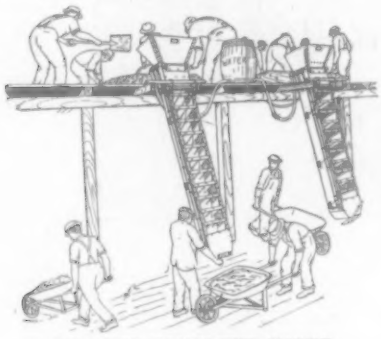
In Repose.



In Action.

WINGET HOLLOW CONCRETE BLOCK MACHINE.

Mass., is devoted to their portable gravity concrete mixer, the general style and manner of operation of which is shown in the accompanying cut. Several of the models are made in sectons so that the mixer can be used in lengths from 4 to 10 feet. There are no moving parts in this mixer and the method of adding water is such as to insure its thorough incorporation in the mass. The usual



GRAVITY CONCRETE MIXER.

descriptions of this machine show it as in use for foundation work, but the four-foot mixer can readily be used for street work if placed on a low movable platform. Four men can feed a gravity mixer, but the concrete is somewhat more even if it is fed by six or eight men. The capacity of the machine is limited only by the ability of men to shovel materials into it in such manner as to produce an even mixture. Four men can easily shovel a cubic yard of the materials into the hopper in three minutes.

## Trade Publications.

A pamphlet issued by Gabriel & Schall, 205 Pearl-st., New York, explains the use of carbonate of barytes, in which they deal, for preventing scum and discoloration of brick, terra cotta and mortar.

The Cleveland Crane and Car Company, Wickliffe, O., send bulletins F. G. H. and J, descriptive of Armington Electric Hoists, and various styles of hand and electric power jib, post, car and traveling cranes.

The American Process Company, 62 William-st., New York, issue a handsome illustrated pamphlet descriptive of the A. P. C. Direct Dryers for all kinds of materials, such, for example, as cement mixture, coal, garbage, marl, sand, sewage, etc.

The catalogue of the Pittsburg Blue Print Company, 1506 Park Bldg., Pittsburg, Pa., explains how their electric blue printing apparatus beats the sun.

The Studebaker Farmers' Almanac for 1904 is out, advertising the Studebaker vehicles made at South Bend, Ind.

The latest catalogue of the Austin Manufacturing Company, Manhattan building, Chicago, Ill., illustrates the gyratory crushers made by the company and many plants for stone crushing in which they are installed. It is interleaved with commendatory letters from many users.

The American Water Purification Company of Boston, Mass., issues a paper by John N. McClintock on "Water and Its Purification by the American System." The American Sewage Disposal Company issues a pamphlet by the same author on "Sewer Building and Sewage Disposal by the American System."

The Morse-Boulger Destructor Company, 39 Cortlandt-st., New York., issues a valuable pamphlet on "The Sanitary Disposal of Municipal Waste," descriptive of the action of the various refuse destructors which the company installs.

"Memories in Cement" and "Good Roads" are two pamphlets issued by the Cement Products Company of Wilmington, Del., and Detroit, Mich., and illustrate a machine for making cement brick.

The prospectus of the F. W. Dunnell Composite-Leather Company, Springfield, Mass., suggests the company's plans for making from leather scraps such products as railroad ties and street paving blocks.

The Nernst Lamp Company, Pittsburg, Pa., publishes an interesting description of this new illuminating apparatus.

W. E. Caldwell Company, Louisville, Ky., sends a catalogue and price list of tanks, towers and tubs for water.

The Jeffrey Manufacturing Company, Columbus, O., issues a unique catalogue of the coal and rock drills which it manufactures.

George C. Callahan & Co., Chicago, Ill., issue a circular descriptive of their gum and liquid "Cimmerian Asphalt," made from petroleum residuum and used as paint for bridges, as pipe dip, for damp courses, electrical insulation, etc.

The National Wood Pipe Company, Los Angeles, Cal., tells "The Whole Story About Wood Pipe" in their catalogue No. 2.

Chas. C. Moore & Co., engineers, San Francisco, Cal., have prepared a booklet on "Steam Power Plants of the Pacific

Coast" which handsomely illustrates and describes plants which they have installed and apparatus which they use.

"Water Purification for Cities by Sulphate of Iron" is the title of a pamphlet issued by the American Steel & Wire Company, Chicago, Ill.

H. J. Livingston, Baltimore, Md., prints a circular descriptive of the results of his process of "annealing" cement, especially for making junctions of new work with that which has set.

The Globe Asphalt Company, 405 Bakewell Bldg., Pittsburg, Pa., refiners of Obispo California asphalt, have issued an illustrated circular containing the evidence collected to show the value of their product for paving and the proof that they have a mine of asphalt from which the material for these pavements is procured, in refutation of contrary statements made in recent New Orleans paving cases.

## Trade Notes.

### ASPHALT.

Asphalt has been discovered in the bed of Great Salt Lake, Utah, and a large number of claims are being staked out.

The Warner-Quinlan Asphalt Co. of Syracuse, N. Y., has filed articles of incorporation at Augusta, Me., with a capital of $1,000,000. The incorporators are J. H. Gallup and G. E. Warner of Syracuse; A. M. French of Winthrop, Me.; I L. Fairbanks of Augusta.

The Cleveland Trinidad Paving Company will move its asphalt plant at Bay City, Mich., to the Crump Mill property in the Fourth ward.

The National Asphalt company, Harrison, Ark., has been incorporated with $1,000,000 capital stock, with officers as follows: President, Allen Smalley, Upper Sandusky, O; vice-president, W. G. Gardiner, Toledo, O.; secretary, John G. Gehan, Harrison, Ark.; treasurer, James Cole, Eureka Springs, Ark.; general manager, Toledo, O.

The General Asphalt company is considering the question of building forty miles of narrow gauge road from Crevasse, near Grand Junction, Colo., to the asphalt beds across the mountains.

George F. Culmer, George C. K. Culmer, H. H. Culmer and H. L. A. Culmer filed in the United States circuit court for the eastern district of Texas Oct. 13, an intervention in the case of Samuel T. Carnes et al. vs. the Central Asphalt and Refining company. The intervenors ask for the removal of W. W. Talbert, who was appointed receiver of the company recently, and asks for the appointment of a disinterested, competent and qualified person in his place.

### BRICK.

The Southern Hydraulic Brick company, Charleston, S. C., contemplates the manufacture of paving brick in the near future. E. H. Jahns, president.

### CEMENT.

The Southern Ohio Portland Cement Company was organized at Toledo, O., Oct. 17 by the following: President, E. T. Affleck, sr.; vice-president and general manager, F. H. Miller, Columbus; secretary, H. C. Adams; treasurer, C. Wesley Merrill. The company has acquired control of 2,500 acres of land in Jackson county and will develop it. A cement plant will be erected at a cost of $500,000 and stone cement will be manufactured.

The Southern States Portland Cement Company has just completed a mammoth plant for the manufacture of Portland Cement, at Rockmart, Ga.

The Roberts Cement Brick and Tile Company, Ltd., Detroit, Mich., has been incorporated by Fred J. Raney, Alfred Roberts, Orville B. and Spencer Eaton and Samuel Lee.

A company is being organized at Pigeon, Mich., to manufacture cement with officers as follows: President, H. H. Gould; vice-president, W. H. Schuber; secretary, C. H. Schenk; treasurer, F. W. Merrick; manager, A. A. Prumner.

The plant of the Wolverine Portland Cement Company at Quincy, Mich., will be closed soon for extensive changes and improvements.

The Union Portland Cement Company, Newark, N. J., was incorporated Oct. 16 by H. J. Ackerman, J. H. Leonard, D. C. Kenyon, M. J. Gottschalk, J. L. Ballinger, D. H. Kermin and W. S. Lehrer.

The United States Portland Cement Company, Pittsburg, Pa., recently organized, has purchased 62 acres of land 2 miles east of Connellsville, and a plant will be erected.

The Thomas Cement Company, Reading, Pa., has been incorporated by Dr. H. Y. Horn, R. E. Wright and Willis S. Morse.

The West Pittsburg Cement Manufacturing Company has been incorporated by C. A. Glaser, L. M. Powell and S. E. Kingsley of Pittsburg, Pa.

The Pomona Lime, Cement and Stone Company, Pomona, Cal., has been incorporated by R. N. Loucks, Dr. M. R. Toland, Frank Smith, Kewen H. Dorsey and J. V. Hannon. Lime and cement will be manufactured.

The Hecla Portland Cement and Coal Company, Detroit, Mich., filed a trust mortgage Oct. 3 for $731,818, conveying all its properties in Bay, Iosco, Ogemaw and Alpena counties to the Detroit Trust Company as trustees. The mortgage is given for the benefit of the creditors to raise funds to liquidate the indebtedness and to make changes in the plant. The company's plant is at Bay City, Mich.

The Delta Portland Cement Company, has been organized.

A company has been organized at South Monterey, Mich., to erect a plant for the manufacture of cement.

The Shinn Slag-Sand Company has been organized in New York City to manufacture cement from blast and furnace slag, according to press reports.

The Edison Cement Company is about ready to resume work at its plant at New Village, N. J.

LIGHTING AND POWER.

The East Coast Electric Light, Power and Ice Company, West Palen Beach, Fla., is a newly organized concern that has absorbed the franchise of the West Palen Beach Electric Light and Power Company. The new company is practically a reorganization of the old company on a more substantial financial basis. Joseph Jefferson is still president.

The Kern Incandescent Gas Light Company, of Jersey City, N. J., has been incorporated.

MISCELLANEOUS.

The Rockford Concrete Construction Company, Rockford, Ill., has been incorporated to conduct a general business in concrete construction by H. C. Phillips, W. R. Keyt and Charles Stowell.

The Stocker Gravel and Artificial Stone Company, Highlands, Ill., has been incorporated by Fred Stocker, Eugene Schott and John Wilde.

The Eddyville Sand Company, Eddyville, Ia., has been incorporated by George H. Carlon of Oskaloosa, Maggie Walker, C. L. Funk and Al Beimer.

Schillinger Bros., Chicago and Toledo, have been incorporated as Schillinger Bros. Company by Henry C. Weidman, Robert Schillinger of Detroit and Frederick Schillinger of Toledo.

The Ironton Artificial Stone Company, Ironton, O., has been organized to manufacture artificial stone by Fred P. Horschel and A. L. Stefanski.

The Lake Geneva Sand and Gravel Company, Fontana, Ill., has been incorporated.

The Utica Cement, Brick and Block Company, Utica, Mich., has been organized to manufacture cement brick and blocks with officers as follows: President, Geo. B. Davis; secretary, E. Corless Kelly; treasurer, H. J. Lamontaine.

The American Granite Brick Company, Washington, D. C., has been organized to manufacture sand-lime brick in the District of Columbia, Virginia, Pennsylvania, Maryland, North Carolina, Alabama and all southern states. The officers are: President, E. C. Wood; vice-president and general manager, John P. Martin; secretary, John P. Martin, jr.

The Amarillo Artificial Stone and Brick Company, Amarillo, Tex., has been incorporated by F. M. Putty, Louis Anthony, R. B. Newcome and J. F. Foster.

The Kansas City Brick Manufacturing Company, Kansas City, Mo., has been incorporated by W. T. Urie, Belle Keyes, Thomas P. Keyes, Joseph S. Graves, W. S. McPaull and B. L. Hammer.

R W. Winters will engage in the manufacture of cement brick at Alpena, Mich.

William R. De Vries, Ida Grove, Ia., will establish a cement block plant. He has purchased machinery of the H. S. Palmer Company.

The Trussed Concrete Steel Company, Detroit, Mich., has been incorporated to manufacture and deal in reinforced concrete. Albert Kahn, Herman Krolik, Day Krolik, George W. Patterson and others are interested.

E. H. Bowser has been appointed general manager of the Southern Creosoting Company, Ltd., Slidell, La.

WATER.

The Pennsylvania Water Improvement Company, 333 High-st., Burlington, N. J., has been incorporated to store and supply water, by Charles Doehler, H. P. McConlogue of Philadelphia, Pa.; Reginald Branch, Burlington, N. J.

## Recent Inventions.

727,233. May 5, 1903. Metal-Bound Curbing. H. H. Wainwright, Philadelphia, Pa. Concrete curb with metal outer corner having rounded outer face, a continuous web projecting into the concrete and a longitudinal dovetail along the inner edge of the web to strengthen hold of metal in concrete.

727,427, 727,428. May 5, 1903. Machine for Molding Hollow Concrete Building Blocks. Harmon S. Palmer, Washington, D. C. The H. S. Palmer machine, with the addition of means for adjusting the hight of the bottom plate and of sides and ends to form blocks of various dimensions.

727,583. May 12, 1903. Composite Piling. Alexander E. Brown, Cleveland, O. A cement pile with an imbedded longitudinal tube made up of sheet metal cylinders fastened together at their ends and having dovetail shaped longitudinal corrugations. The tubes overlap and can telescope.

727,693. May 12, 1903. Road Grading and Ditching Machine. Richard Russell, Stephen, Minn. A wheeled frame, transverse water-tight conveyor box, scoop with cutter edge for scraping up earth and belt conveyor for pushing earth through the box to the discharge end.

727,706. May 12, 1903. Elevator or Storage Bin Construction. B. H. Starke, Minneapolis, Minn. Vertical and horizontal rods, not connected, near outer surfaces of walls and partitions of concrete, also inclined bottoms of similar construction, supported at intervals on reinforced concrete beams.

727,989. May 12, 1903. Sectional Sheet Piling and Means for Sinking Same. Hiram A. Miller, Clinton, Mass. A series of three planks connected together with an opening in one of the outer ones connecting with a channel in the inner

through which to force water to the foot of the pile to wash out material for sinking the pile.

727,990, 727,991. May 12, 1903. Siphons. Sidney W. Miller, Chicago, Ill. Addition to the sewage siphon of an auxiliary trap with less depth of seal and means of varying this depth without disturbing the setting, and means for refilling the auxiliary trap from the tank. Also a supplemental pressure device for forcing tne trap and starting the siphon, located in a timing chamber filled from the tank and emptied through the siphon.

728,065. May 12, 1903. Packing for Pipe Joints. Elias G. Wright, Guildford, Eng. A ring or band of compressed granulated cork coated with a solution of bitumen.

728,136. May 12, 1903. Wheeled Scraper or Self-Loading Cart. Charles H. Sawyer, Minneapolis, Minn. In a wheeled scraper the combination with the lever and sand band of a semi-sleeve integral with the band and having grooved straps or ears to receive the lever.

728,220, 728,221. May 19, 1903. Disinfecting Apparatus. Eugene Fournier, Paris, France.. A disinfecting chamber heated by air introduced from a heating apparatus with double bell heating the air by radiation and directly, and generating disinfecting vapors which are injected into the chamber; airtight door closure and other necessary appliances.

728,337. May 19, 1903. Burial Vault. B. F. Van Camp, Warsaw, Ind. Concrete vault with steel strengthening frame embedded therein.

728,345. May 19, 1903. Expanded-Metal Structure. Herbert E. White, Niles, O. A form of expanded metal.

728,391. May 19, 1903. Excavator. E. V. Grant and N. W. Shears, Los Angeles, Cal. An endless belt and conveying bucket automatically opening and closing at and after discharge of contents.

728,451. May 19, 1903. Road Roller. W. M. Fawsett and C. L. Heisler, Erie, Pa. The steering gear for a self-propelled road roller.

728,497. May 19, 1903. Combined Coffer-Dam and Caisson. William T. Pool, Columbus, Ga. A casing of spacing beams to which are secured double walls with the space filled with cement, a flexible apron at the bottom, and air-lock at the top and a means of discharging material through one side of the caisson by means of the compressed air in the caisson.

728,691. May 19, 1903. Reservoir Construction. Powell Evans, Philadelphia, Pa. A water tank with independent chambers each serving water for fire extinguishing to a different floor of a building, with means of replenishing the supply of water.

728,693. May 19, 1903. Combined Curb and Gutter. W. H. Ferguson, Denver, Colo. Made of cement concrete with metallic reinforcement near outer surface and having hollows in the inner side of the curb portion.

# IMPROVEMENT AND CONTRACTING NEWS

## *PAVING.*

Bushnell, Ill.—The time for the approval or non-approval of the paving assessment for district No. 2 was continued from Oct. 17 to Nov. 3.

Kansas City, Mo.—The Parker-Washington Paving company asked the Upper House of Councils, Oct. 5, to annul their paving contracts, made two years ago, asserting that the courts have ruled the tax bills invalid. The council complied with the request.

### CONTEMPLATED WORK.

Birmingham, Ala.—Asphalt paving is proposed for Fifth-ave.

Nashville, Ill.—Mill and Court-sts. are to be macadamized.

Stillwater, Minn.—Chestnut and Myrtle-sts. are to be repaved.

Racine, Wis.—The merchants on Main-st. desire asphalt paving.

Frederick, Md.—An ordinance has been passed for paving Market-st.

Pittsfield, Mass.—Asphalt paving has been decided upon for East-st.

Altoona, Ill.—An ordinance has been passed for paving Eleventh-st. with brick.

Fremont, Neb.—Brick paving on three streets is contemplated. S. F. Stiles, city clerk.

Menominee, Mich.—Bitulithic paving will be constructed on Grand-ave. or State-st. next year.

St. Bernard, O.—An ordinance has been passed to improve Albert-st., from Bertus to Leonard.

Atlanta, Ga.—Piedmont-ave. from Sixth-st. to the Driving Club, will be paved wtih bitulithic pavement, which is manu-

factured by Warren Bros. Company of Boston.

Denver, Colo.—The board of public works decided Oct. 17 to pave Ogden-st., from Eighteenth to Twentieth, with basalt.

Rome, N. Y.—The property-owners on W. Thomas-st. have petitioned for asphalt paving. Cy. Engr. Schillner.

Akron, O.—Petitions for street improvement to be made next year must be in the possersion of council this winter.

Williamsport, Pa.—A cement walk through Brandon park is contemplated. John F. Laedlem, prest. Brandon Park Com.

Port Huron, Mich.—Estimates have been prepared for paving Tenth-st. with tar macadam, brick or bitulithic pavement.

Brooklyn, N. Y.—About 25,000 signatures have been secured for constructing a speedway adjacent to the Ocean Parkway.

Castile, N. Y.—An ordinance has been passed requiring the building of cement or stone sidewalks only. Vil. trustees.

Houston, Tex.—Paving is contemplated for Chartres-st. Plans and specifications ing Livingston-st. from Main to Walnut are being prepared for paving Lubbock-st.

Cincinnati, O.—Ordinances have been passed to pave Gilbert-ave., from Sparta-st. to Woodburn-ave. Edwin Henderson, clk.

Corning, Ia.—A resolution has been passed to construct permanent sidewalks of cement, cut stone or paving brick. S. E. Day, cy. clk.

New Albany, Ind.—The property-owners on E. Sixteenth-st., from Spring to Elm, submitted a petition Oct. 19 to council asking for vitrified brick paving.

Saginaw, Mich.—The committee on pavements and sewers have recommended that cedar block pavement in certain districts be replaced with new material next year.

Ironton, O.—Petitions are being circulated for paving Fifth-st., between Hecla and Mill, with asphalt with combination curb and gutter and Park-ave., from Second to Ninth, with block asphalt or brick.

Petaluma, Cal.—(Special)—N. S. Frost, city engineer, says he is preparing specifications and resolutions for grading, curbing and oiling Bodega-ave. in the town of Sebastopol, sixteen miles north of Petaluma.

Peoria, Ill.—The city engineer has been directed to prepare plans for paving Hamilton boulevard, from Jefferson to Monroe, the present street, with asphalt over brick pavement. A resolution has been passed to pave Oak and Spencer-sts. with brick.

### CONTRACTS TO BE LET.

Madison, Wis.—Bids are asked until Nov. 12 for macadamizing Mill-st. O. S. Norsman, cy. clk.

Toma River, N. J.—Sealed bids are asked until 12 M., Nov. 10, for constructing three and one-half miles gravel roads in Ocean twp. Isaiah Stackhouse, chmn. road com.

Cincinnati, O.—Bids are asked until Nov. 14 for repairing a portion of Plainfield turnpike in Columbia twp. E. S. Lewis, co. audt.

Bluffton, Ind.—Sealed bids are asked until Dec. 8 for building fifteen gravel roads in Jackson twp. David Ochsenrider, chmn. co. cmrs.

Cape May, N. J.—Bids are asked until Nov. 5 for rebuilding the Cape May county turnpike road. William T. Bate, dir. bd. freeeholders.

Port Townsend, Wash.—Sealed bids are asked until 2 p. m., Nov. 14 for constructing road, granolithic walk, etc., at Ft. Worden, Wash. George H. Penrose, Q. M. U. S. A.

Monticello, Ind.—Sealed bids are asked until 7 p. m., Nov. 3, for building sidewalks on Broadway, between Main and Tippecanoe-sts. Edmund R. Brown, chmn. bd.

Paoli, Ind.—Sealed bids are asked until 2 p. m., Nov. 5, for building gravel or macadamized roads as follows: Northwest twp., 18,700 ft.; French Lick twp., 5,300 ft.; Orleans twp., 5,220 ft. John H. Weeks, chmn. co. comrs. Geo. W. Tegarden, co. audt.

### CONTEMPLATED WORK.

Boise, Idaho—P. H. McDonald submitted the lowest bid Oct. 12 for constructing cement sidewalks.

Zanesville, O.—The contract for paving Moorehead alley from Main to South, was awarded to Adams Bros.

Lisbon, O.—J. A. Smith was awarded the contract, Oct. 20, for paving Nelson-ave. at $1.52 a sq yd.

Asheville, N. C.—The contract for bitulithic pavement has been awarded Warren Bros. Company of Boston.

Jackson, Mich.—E. J. Tobin & Co. was awarded the contract for paving alleys with brick on concrete.

Dekalb, Ill.—The contract for paving State-st. was awarded to the Federal Asphalt Company for $18,822.

Des Moines, Ia.—The contract for curbing W. Thirteenth-st. was awarded Oct. 22 to W. F. Cook at 43 cts. a lin. ft.

Washington, D. C.—The contract for laying cement sidewalks was awarded to the Colburn Paving Company for $73,000.

Ft. Dodge, Ia.—The contract for asphalt paving was awarded to the Barber Asphalt Paving Company at $2 a sq. yd.

Waukesha, Wis.—Fred Boortz secured the contract for paving Williams-st. with brick over macadam at $1.37 a sq. yd.

Middletown, Conn.—Roger Kennedy has been awarded the contract for macadamizing two sections of highway in West brook.

Bismarck, N. D.—The contract for constructing additional roads at Ft. Lincoln was awarded to Thomas Fortune for $1,170.

Baltimore, Md.—A. Hook, Jr., has been awarded contracts for macadamizing Tenth-st. for $5,856 and Clifton-ave. for $4,479.

Kewanee, Ill.—The contract for paving S. Main-st. with asphalt was awarded to the Barber Asphalt Paving Company of Chicago.

Schenectady, N. Y.—The contract for paving Foster-ave., Bradley alley and Strong-st. was awarded to the Schenectady Contracting Company.

Portsmouth, O.—The contract for paving Offnere-st., from Fourth to Gallia, was awarded, Oct. 13, to Kelley Bros., city, for $7,562.31.

Rochester, N. Y.—Whitmore, Rauber & Vicinus secured the contract, Oct. 16, for paving Church-st., from State to Fitzhugh, for $4,258.

Lexington, Mo.—The contract for paving the main street of this city was awarded Oct. 17 to George T. Menefee of Sedalia for about $20,000.

St. Charles, La.—The contract for paving Ryan-st., from Clarence to Lawrence, was awarded to the Barber Asphalt Paving Company for $54,117.30.

Bristol, Conn.—The contract for building two sections of macadam road was awarded Oct. 20 to Martin E. Pierson of Hartford at $1.25 a lin. ft.

Watertown, Conn.—The contract for constructing a macadam and telford road was awarded to Frank Arragoni & Bro. of Durham Center, at $2.18 a lin. ft.

Newark, N. J.—Warren Bros. Co. of Boston was awarded the contract, Oct. 5, for paving Clinton-ave., Osborne Terrace and Bleeker-st. with bitulithic pavement.

Columbus, O.—D. E. Sullivan & Co. was awarded the contract for paving First-ave. from Neil to Perry for $19,895.80, and Tenth-ave. from Michigan to Neil for $3,890.80.

Rochester, Ind.—The contract for twelve blocks of brick to Hugh Woods & Co. of Decatur, Ind., at $1.58 a sq. yd. for brick, and 44 cents a lin. ft. for stone curbing.

Greenville, Miss.—The Southern Paving Co. of Chattanooga has been awarded contracts for 30,000 sq. yds. of brick paving and 10,000 lin. ft. of curbing for $90,000.

Elizabeth, N. J.—The contract for 1,720 sq. yds. of trap block paving was awarded Oct. 15, at $1.60 a sq. yd., and for 2,040 sq. yds. of Telford at $1.30 a sq. yd. to W. H. Weldon of Rahway.

Dixon, Ill.—The contract for paving N. Galena-ave. and First-st. with brick was awarded to Duffy & Hubbard at 30 cts. a cu. yd. for grading, and $1.25 a sq. yd. for paving. Total, $10,033.60.

Jamestown, R. I.—Contracts for constructing sections of state highways were awarded Oct. 7 as follows: Warwick, 2,640 ft., to town of Warwick, $1,995; Jamestown, 2,640 ft., Amos S. Peckham, $3,686.

Dayton, O.—(Special)—Bids were submitted Oct. 20 for paving Linden-ave. from Third-st. to Newcome-ave. Warren Bros. Co. of Boston submitted the lowest bid, which provided for bitulithic pavement.

Chicago, Ill.—Paving contracts were awarded Oct. 2 as follows: R. F. Conway Co., Cleveland, S. Hermitage and Milwaukee-aves., and Fourteenth-st.; A. Jaicks Company, W. Lake-st.; Citizens' Construction Company, W. Huron-st.

Cincinnati, O.—The totals of the bids received for resurfacing Race-st. with asphalt were only $1.88 apart, the Barber Asphalt Company's bid being $50,045 and the Kirschner Company's bid $50,233. The bids were refused.

Camden, N. J.—The contract for paving Fourth, Carpenter, Sixth, Pine and Walnut-sts. with asphalt was awarded Oct. 6. to the Vulcanite Paving Company at $1.89, and for paving George-st. from Front-st. to Delaware-ave. with Belgian block at $1.25 a sq. yd.

Celina, O.—Kelly Bros. of Portsmouth, O., were awarded the contract for pav- for $3,849. The contract for paving E. Market-st. with asphalt block was awarded to the Lake Erie Asphalt Block Company of Toledo for $25,421.

Davenport, Ia.—The Barber Asphalt Paving Company of Chicago was awarded contracts Oct. 13 for paving Eleventh-ave. for $5,753.48 and Eighth-st. for $5,126.78. The Tri-City Construction Company was awarded the contract for paving Eleventh-ave. from Ninth to Thirteenth-st. for $9,930.

Washington, D. C.—The contract for grading and macadamizing the Massachusetts-ave. bridge and its approaches were awarded, Oct. 17, to Cogan & Forschner at 45 cts. a sq. yd. for grading; 40 cts. for cobble gutter; 96 cts. per load for hauling macadam; total, $5,906.

St. Joseph, Mo.—The contract for reconstructing the macadam pavement on Messari-st., between Tenth and Fifteenth-sts., was awarded Oct. 15 to Rackliffe & Gibson. Farmer & Dunn secured the contracts for paving Michel-st. and for reconstructing the macadam pavement in Main-st.

Brooklyn, N. Y.—Bids were opened Oct. 21 for building sidewalks on Church-ave. as follows: Daniel Douglas, $19,078; Dennis Norton, $17,650; William E. Ficklin, $18,983; Chapman & Ryan, $19,075; Thomas F. Timoney, $15,508; Fred Luck, $15,614; Vulcanite Paving Company, $17,906; Rockefeller & Hazzard, $17,853.

Cincinnati, O.—Paving contracts were awarded Oct. 21 as follows: Sixth-st., from Sycamore to Broadway, asphalt, Kirchner Construction Company, $6,161.40, and Seventh-st., from Main to Broadway, asphalt, $6,965.50; Culvert-st., from Third to Fifth, granite, $9,429.60; Fern-st., from Reading road to Stanton-ave., asphalt, Barber Asphalt Paving Company, $14,958.

York, Pa.—The York Stone Macadamizing & Grading Company was awarded the contract Oct. 20 for macadamizing Sherman, Patterson, E. Philadelphia, Poplar, N. Queen and Duke-sts. and Rouse-ave. at $1.14 per perch; W. H. Duttera, N. Hartley-st., $1.20 a sq. yd.; John Stover, W. Poplar and Hawthorne-sts., $1.25 per perch for stone and 25 cents

a cu. yd. for grading; Phillip J. Kottcamp, Cottage Hill-ave., $990.

Buffalo, N. Y.—(Special)—Bids were submitted Oct. 12 for repaving Erie-st. from Swan-st. to Lower Terrace with dressed Medina block from the German Rock Asphalt and Construction Company and Henry P. Burgard but neither bid was accepted. Bids were also received for repaving Perry-st. from Main to Michigan with asphalt and for paving St. Stephen's place with asphalt.

Petaluma, Cal.—(Special)—N. S. Frost, city engineer, says contracts have been awarded as follows: Upham-st., J. Werruli, grading 43 cents a cu. yd.; basalt block curbing, 15½ cents a lin. ft.; broken stone gutters, 8 cents a sq. ft.; macadamizing, 5 cents a sq. ft.; wooden culverts, $15 each. Third-st., Union Construction Company, basalt block curbing, 15⅛ cents a lin. ft.; broken rock gutters, 9 cents a sq. ft.; grading and macadamizing, 5½ cents a sq. ft; wooden culverts, $20 each. Washington-st., J. R. Nesbitt, grading, 41 cents a cu. yd.; basalt block curbing, 15½ cents a lin. ft.; broken rock gutters, 5¼ cents a sq. ft.; macadamizing, 5⅛ cents a sq. ft.

## SEWERS.

Newark, N. J.—The Harrison Construction Company has asked to be released from its contract with West Orange for constructing lateral sewers, and that the contract be given to G. M. Gest of New York City. The company's reason for withdrawing is that it has recently been awarded a number of large contracts and feels that it cannot properly execute the contract in West Orange without heavy forces and possible delay.

### CONTEMPLATED WORK.

Holton, Kas.—A sewerage system is contemplated.

Eau Claire, Wis.—A sewer in State-st. is proposed.

Tonawanda, N. Y.—Sewers for Gastown are proposed.

Janesville, Wis.—Storm sewer at Five Points is contemplated.

Spring Grove, Pa.—The question of a sewerage system will be voted on.

South Manchester, Conn.—Plans for a sewerage system have been accepted.

Brookings, S. D.—Plans for a complete sewerage system have been prepared.

Marshall, Minn.—Plans are being prepared for extending the sewerage system.

Torrington, Conn.—A resolution has been passed to build a sewer near School-st.

Rushville, Ind.—The question of sewers was defeated Oct. 20 in the council.

Des Moines, Ia.—The septic tank system is proposed for low sections of this city.

Van Wert, O.—A 12-in. sewer on Central-ave., from Wayne to Race-st., is contemplated.

Portland, Me.—The extension of the Preble-st. sewer to tide water is contemplated.

Seneca Falls, N. Y.—The question of building a sewerage system will be voted on in March.

Aberdeen, S. D.—Plans for sewage disposal will be made by Benezette Williams of Chicago.

Marion, O.—A resolution has been passed to issue $50,000 bonds for a sewage disposal plant.

Marinette, Wis.—The plans for a new sewerage system have been submitted by Harry McCallum, cy. engr.

Ottawa, Ont.—Plans for a sewerage system in East Ottawa are being prepared by Cy. Engr. Wilson.

Anoka, Minn.—A new sewerage system for this place is being discussed by the state board of health.

Toledo, O.—The state board of health has approved the plans for sewers Nos. 36 and 39 and Central-ave.

St. Johns, N. F.—Plans for a sewerage system are being prepared by John Galt, C. E. of Toronto, Ont.

Red Oak, Ia.—A resolution will come up for final action Nov. 2 for building a sewer. C. M. Kelly, cy. clk.

Ogden, Utah.—Mayor Glasman has suggested a plan for constructing a sewer in the northwestern part of this city.

Woonsocket, R. I.—Ordinances have been prepared to build sewers in a number of streets. Wm. C. Mason, cy. clk.

New Britain, Conn.—Profiles for an extension of the sewer in Cherry-st. have been prepared. F. H. Oldershaw, cy. engr.

Lansing, Mich.—The estimated cost of building sewers in Sycamore, Robert, Townsend and South-sts. is $15,600. Cy. Engr. Collen.

Hartford, Conn.—Plans for a sewerage system at Mantie, the state military rendezvous, have been made by Cy. Engr. Crandall of New London.

Wyandotte, Mich.—A report has been adopted recommending that Riggs & Sherman of Toledo, O., be employed to make plans for a sewerage system.

Belleville, Ill.—Mayor Fred I. Kern is interested in sewage disposal and septic tanks, and desires to communicate with parties for information.

Normal, Ill.—The cy. council has decided to extend the brick sewer from Mulberry-st. north along the creek valley to the culvert under the Illinois Central R. R.

Dover, Del.—Council has requested that the plans for a sewage disposal system be revised so that the cost of the proposed system will not exceed $25,000.

### CONTRACTS TO BE LET.

Mishawaka, Ind.—Bids are asked until Nov. 2 for sewers in Sixth and Third-sts. Cy clk.

Boise, Idaho—Sealed bids are asked until 12 m., Nov. 14, for constructing a ditch. J. L. Ackerman, co. audt.

Eldora, Ia.—Bids are asked until Nov. 11 for about 22,700 ft. of tile drain. Jay S. Newcomer, co. audt.

Albert Lea, Minn.—Sealed bids are asked until 7:30 p. m. Nov. 5. (readvertisement) for constructing the main sewer.

Glenolden, Pa.—Bids are asked until Nov. 4 for constructing about 7 miles of pipe sewers. H. J. Black, chmn. sewer com.

Weiser, Idaho—Sealed bids are asked until Nov. 23 for constructing a sewerage system in dist. No. 1. J. B. Coakley, chmn. sewer com.

Washington, D. C.—Sealed bids are asked until Nov. 19 for a sewer system at Grand Junction, Colo. W. A. Jones, comr. Indian Affairs.

Hammond, Ind.—Sealed bids are asked until 7:30 p. m., Nov. 3, for constructing a 24-inch sewer in Towle and Cameron-sts. W. F. Bridge, cy. engr.

Clinton, Ia.—Sealed bids are asked until 8 p. m., Nov. 10, for constructing a combined storm and sanitary sewerage system. Harry E. Oates, cy. clk.

Hannibal, Mo.—Sealed bids are asked until Nov. 10 for constructing certain levees, drains, ditches and other work for the South River Drainage district. J. McTurner, chmn. comrs.

Chicago, Ill.—Sealed bids are asked until 12 m., Nov. 4, for excavating a channel as an extension of the North Branch of the Chicago river northward to Lawrence-ave. Thos. A. Smythe, prest. bd. trustees.

Seattle, Wash.—Sealed bids are asked until 11 a. m., Nov. 7, for openings, connections, Y's, manholes, lampholes, ventilators, flushing tanks and catch-basins in a large number of streets. C. B. Bagley, secy. B. P. W.

### CONTRACTS AWARDED.

Guthrie, Okla.—Plumber & Brummidge secured the contract for a lateral sewer.

Manchester, Ia.—The contract for sewer was awarded to D. H. Young of this city.

Springfield, O.—Dan Doyle was awarded the contract for a sewer in Clifton-ave. for $4,113.20.

Montgomery, Ala.—The contract for a sewer in Cleveland-ave. was awarded to T. A. Davis for $4,831.50.

Cass Lake, Minn.—The contract for a sewer was awarded to Pastoret & Martiff of Two Harbors for $2,000.

Ames, Ia.—O. P. Herrick was awarded the contract for two miles of sewers and a septic tank for $24,281.

Corning, Ia.—Dunnegan & Corey of Shenandoah, Ia., secured the contract Oct. 14 for a new sewer for $4,200.

Harrisburg, Pa.—The contract for building 8 sewers was awarded Oct. 12 to Geo. B. Stucker for $4,806.42.

Huntsville, Ala.—The contract for completing the trunk line sewer was awarded to Hutchens & Murdock for $7,300.

Waterford, Conn.—The contract for a sewer on Spring-st. was awarded to the J. H. McCormick Steam Heating Company.

South Bend, Ind.—The contract for a sewer in Catalpa-ave. was awarded to Peter Suzio and in E. Colfax-ave. to Hoban & Roach.

Boulder, Colo.—The contract for a sewer at State School for the Deaf and Blind was awarded to Charles Hodson at 45 cts. a lin. ft.

Alma, Mich.—(Special.)—G. S. Young, village president, says that the contract for 260 rods of sewer was awarded to Ray & Clarke for $3,264.

Davenport, Ia.—Hoeppner & Niermann secured the contracts for sewers in Sixth and Oak-sts. and Lincoln and Hancock-aves. and College-ave.

Jonesboro, Ind.—The contract for a sewer from the new school building to First-st., thence to the river, was awarded to F. M. Beimer of Marion for $8,454.

Petaluma, Cal.—(Special.)—N. S. Frost, cy. engr., says the contract for a 6-inch pipe sewer in Bassett-st. has been awarded to J. R. Nesbitt at 70 cts. a lin. ft. Manholes, $30 each.

Mansfield, O.—W. H. Ralston of Zanesville was awarded contracts for sewers in E. First-st., Franklin-ave. and Foster-st. George B. Herring & Son secured the contracts for sewers on Sherman-ave.

Buffalo, N. Y.—Beaser Bros., 73 Sanford-st., have been awarded the contract for constructing a 24-inch brick and 20 and 18-inch tile sewer in New South Ogden-st., between William and Dwiggins-st. at their bid of $3,836.

Wichita, Kas.—The contract for constructing a sewer in Dist. No. 4 was awarded to the Sumption Sidewalk Company for $9,738, instead of to Dorsey of Terre Haute, Ind., as stated in the October number of Municipal Engineering.

Winton Place, O.—Bids were received Oct. 15 for building 5½ miles of pipe sewers, as follows: G. M. Gest, $39,064; McCarthy Bros., $41,194; Jos. Espel, $41,712; W. H. Louthan, $40,234; Van Sant & Meeds, $39,907; Thos. P. Strack, $39,994.

Denver, Colo.—The contract for storm sewers in sub-district No. 10 was awarded to the Western Realty and Paving Company Oct. 9 for $5,300; sub-dist. No. 11, Cramer & Gibbons, $7,400.

West Orange, N. J.—The Harrison Construction Company of Norwalk was awarded the contract for building section 1 of the sewerage system for $19,050.50; John F. Driscoll of Orange, three contracts for section 2, $19,250.40; Chas. Ippolito of Orange section 3, $13,163.35.

Buffalo, N. Y.—(Special.)—The following bids were received for work on the new sewage pumping station: H. P. Burgard, Prudential Bldgs., for constructing receiving chambers and pumping pits, $32,000; B. I. Crooker, Builders' Exchange, for erecting engine and boiler house, $14,390; B. I. Crooker, erecting self-supporting steel plate chimney, $5,457.

Contracts were recommended Oct. 19 as follows: 20, 18, 15, 12 and 10-in. tile sewer in Lawrence-ave., Geo. W. Moore, $1,700; Delaware-ave., Dark & Co., $3,250; Sixteenth-st., Miller & Franklin, $4,590; South Side Parkway, Henry C. Betz, $1,006; Strathmore-ave., W. G. Smith, $1,401; Humason-st., Frederick J. Munn, $2,349; Main-st., W. G. Smith, $998; brick trunk sewer, Bertha-st., Abbott road, Ger-

mania, Tiffe and Hopkins-sts., Dark & Co., $74,900; 2-ft. tile sewer, Dewey-ave., Miller & Franklin, $4,440.

## WATER-WORKS.

Paola, Kas.—The water works plant was sold at public sale Oct. 7, by order of the U. S. court to Charles F. Sheet for $20,000.

Lititz, Pa.—The citizens will vote in November on the question of increasing the borough indebetedness $45,000 to purchase the plant of the Lititz Water Company.

Fishkill Landing, N. Y.—This village and Matteawan voted in favor of municipal ownership of water works, Oct. 14, and will purchase the plant for $130,000.

Augusta, Me.—The appraisers, appointed to determine the value of the Main Water Company's property and franchise, fixes the valuation of the entire plant at $45,000.

Helena, Mont.—The citizens committee, appointed to appraise the property of the Helena Water Works Company with a view to bringing about a sale of the plant to this city, fixes its value at $50,000.

Alexandria, Pa.—The Alexandria Water Company has been incorporated to supply and distribute water through this borough, build water works, etc., by John Phillips, E. P. Walker of Alexandria and William Thompson of Philadelphia.

Taunton, Mass.—The water commissioners of this city issued notices in Middleboro and Lakeville, Oct. 17, warning all people that they cannot fish, boat, cut ice, swim or enter upon any portion of or in the immediate surroundings of Assawompsett and Elders ponds in those two villages.

White Plains, N. Y.—Another appraisal of the Westchester Water works, which were purchased in 1896, through condemnation proceedings for $103,000, has been ordered by the court of appeals. It is not yet known on what grounds the court reverses the decision of the appellate division sustaining the purchase.

### CONTRACTS TO BE LET.

Laramie, Wyo.—The water supply of this city is inadequate.

Brooklyn, N. Y.—Bids are asked until Nov. 4 for furnishing and delivering stop cocks. Robt. Grier Monroe, comr. water sup., etc.

Helena, Mont.—Sealed bids are asked until 12 m. Nov. 25 for constructing a complete water system or for parts of said system. Edward Horsky, cy. clk.

Jackson, Tenn.—Sealed bids are asked until 2 p. m. Nov. 24 for 1 pumping engine, with all auxiliaries, fittings, pipes, special tools, etc. Sam C. Lancaster, cy. engr.

### CONTEMPLATED WORK.

Ecorse, Mich.—The estimated cost of a water works system is $32,452.

Sandusky, O.—The B. P. S. will have plans made for a filtration plant.

Litchfield, Minn.—The purchase of a new pump for the water works is proposed.

Tacoma, Wash.—This city will extend its water system to school section No. 36.

Bellaire, O.—The question of extending the water service will be voted on Nov. 3.

Chester, Ill.—Estimates for a water-works system will be made by Charles A. Stookey.

North Andover, Mass.—This town will vote on extending its mains through Essex and Bradford-sts.

St. Johns, N. F.—Plans for a water works system are being prepared by John Galt, C. E., Toronto, Can.

Stillwater, Minn.—The question of municipal ownership of the water works plant will be voted on Nov. 3.

Wrentham, Mass.—The estimated cost of municipal water works with Archer's Pond as source of supply, is $87,000.

Reading, Pa.—The water board has recommended an appropriation of $60,000 for a filter plant for the Antietam supply.

Portland, Ore.—Extensive additions to the water works system will be made, including the laying of new water mains.

The question of issuing bonds for building water works will be voted on as follows: Prophetstown, Ill., Nov. 2; Miamisburg, O., in Nov.; Osceola, Ia.

The construction of water works systems is contemplated at the following places: Holton, Kas.; Scottsburg, Ind.; Bowbells, N. D.; Clark, S. D.; Arthur, Ill.; Rulo, Neb.; Hartsells, Ala.; Newton Falls, O.; Brooklyn, Ind.; Smiths Grove, Ky.

The question of issuing water works bonds has been favorably voted on at the following places: Franklin, Tenn.; Linden, Mich.; De Soto, Mo.; Mohawk, N. Y.; Tama, Ia.; Delta, Colo.; Okmulgee, Ind. Ter.; Greeley, Neb.; Hickory, N. C.

Monmouth, Ill.—New plans for relieving the present condition at the water works plant are proposed which involve the replacing of the present pumps with new ones.

### CONTRACTS AWARDED.

LeRoy, Ill.—The contract for laying 4 blocks of water mains was awarded Oct. 12 to A. H. Morris of this city for $833.73.

Concord, N. H.—Henry R. Worthington, N. Y. City, was awarded the contract for furnishing duplicate pumps for the Concord W. W. Co.

Onaway, Mich.—The contract for the extension of the water works system was awarded to T. C. Brooks & Sons of Jackson for $10,543.

Freeport, L. I.—The contract for extending the water works system was awarded to A. R. Applegate & Co. of Patchogue for about $6,000.

Anderson, Ind.—The contract for a fil-

tration plant was awarded to the New York Continental Jewell Filtration Co., N. Y. City, for $27,700.

Lennox, S. D.—The contract for constructing a municipal water works system was awarded Oct. 13 to W. D. Lovell of Des Moines, Ia., for $8,450.

West Rutland, Vt.—The contract for constructing 3 reservoirs and 10 mls. of pipe was awarded to Sherman, Hurd & Co. of Syracuse for $60,000.

West Middlesex, Pa.—The contract for laying water mains and constructing a reservoir for the new water works system was awarded Oct. 8 to Wm. McIntyre & Sons of Sharon for $16,000.

Atlantic City, N. J.—The C. P. Allen General Contracting Co. of Denver, Colo., was awarded the contract Oct. 2 for constructing 2 miles of 30-inch wooden conduit across the meadows for $28,425.65.

Alexandria Bay, N. Y.—The contract for a pumping station and laying mains for the new water works system was awarded to Barlow & Woodcock of Seneca Falls. The pumps will be furnished by Rumsey & Co.

Tacoma, Wash.—The contract for 5,870 feet of stave pipe was awarded Oct. 13 to the Washington Pipe and Foundry Company, city, at 24 cents per foot for 6-in., 17 cents for 4-in., 13 cents for 3-in. and 10 cents for 2-in. pipe.

East Orange, N. J.—Contracts on section 1 of the water works system were awarded Oct. 12 as follows: C. I. pipe and special castings, Warren Foundry and Machine Company, New York City, $58,693; valves, Kennedy Valve Company., New York City, $1,102; laying pipe, Richard H. Kernan, So. Orange $17,722.

Buffalo, N. Y.—(Special.)—Bids were submitted Oct. 7 as follows: Constructing three horizontal centrifugal pumps, 3 direct connected vertical compound condensing engines and auxiliary machinery required to drive them—H. P. Burgard, Buffalo, for Lawrence Machine Company, $25,000; Camden Iron Works, Philadelphia, $29,982; C. H. Bradley, jr., & Co., $36,000. Boilers to be used in connection with pumps, Bradley & Co., $8,298; Thayer & Co., $10,500; H. P. Burgard, $15,000.

Wilmington, Del.—Contracts were awarded Oct. 19 as follows: Furnishing, 1,000 ft. pipe, United States Cast Iron Pipe and Foundry Company of Philadelphia, $25.40 per ton; 50 hydrants, R. D. Wood & Co., Philadelphia, $25.40 each; 10 valves, Frank W. Dilks, Philadelphia, $10.85 and $29.50 each.

## BRIDGES.

Wheeling, W. Va.—A new bridge across Market-st. is proposed. Mayor Sweeney.

Jordan, N. Y.—A bridge across Seneca river to replace the present structure is proposed.

Huron, N. Y.—Plans for a steel bridge across Great Sodus bay at Resort are being discussed.

Belvidere, N. J.—Plans are about completed for a new bridge to replace one destroyed by floods.

Newark, N. J.—A new bridge across the Passaic river at Avondale is favored by the freeholders' committee.

Des Moines, Ia.—Bids will be received Nov. 6 for building a bridge at E. Sixth-st. B. O. Hanger, chmn. B. P. W.

Greenfield, Ind.—Bids are asked until Nov. 7, according to press reports, for building 14 new bridges. Moses Bates, comr.

Pontoosuc, Mass.—A petition is being circulated in the vicinity of Bel Air dam for the construction of a new bridge over the dam.

Kansas City, Kas.—Sealed bids are asked until 12 m. Nov. 19 for a steel bridge across the Kansas river at Fifth-st. Frank Holcomb, co. clk.

New Brunswick, N. J.—Sealed bids are asked until Nov. 4 for constructing a bridge over a stream at Raritan lake. Asbury Fountain, dir. bd. chosen freeholders.

Providence, R. I.—The cost of a new iron bridge over the Pawcatuck river on the new road between Carolina and Wood River Junction is being ascertained by a committee.

Buffalo, N. Y.—(Special.)—Bids were received for constructing a foot bridge over the tracks of the Lake Shore and Michigan Southern R. R. at Multon-st. by the Grade Crossing Commission as follows: King Bridge Company, Cleveland, O., expanded metal construction, $17,810 and steel rod construction, $17,560; American Bridge Company, New York City, $14,757 and $14,541 respectively. The Aldermanic committee on bridges favors the construction of the following bridges: Over Erie canal at Evans-st.; over Slip No. 1 at River-st.

## PARKS.

Marion, O.—The question of issuing $10,000 for a city park will be voted on Nov. 17.

New York City.—The park board has authorized an issue of $150,000 for park purposes to be divided equally among the boroughs of Manhattan, Brooklyn and Queens.

Providence, R. I.—The park commissioners are preparing to improve Blackstone-boulevard, by setting out trees, shrubs, etc. The park plans prepared by Olmstead Bros. were discussed by the park board Oct. 2.

## STREET LIGHTING.

Columbiana, O.—An arc light system is proposed.

Saranac, Mich.—An electric light system is proposed.

Middleport, N. Y.—(Special.)—The Akron National Gas Co. has asked for a franchise.

Wakonda, S. D.—A new street lighting system is proposed.

Roanoke, Va.—A municipal lighting plant may be considered.

Capac, Mich.—Bids will be asked soon for constructing an electric light plant.

Juneau, Wis.—This city voted Oct. 19 to install a municipal gas lighting system.

Alhambra, Cal.—Bids for an electric light franchise will be received Nov. 24. Town trustees.

Mohawk, N. Y.—This village voted to appropriate $30,000 for a new duplicate electric light plant.

Miller, S. D.—Stephen Pauly is interesting the citizens in the question of constructing an electric light system.

St. Paul, Minn.—An ordinance was passed Oct. 15 appropriating $20,000 for the purchase of 2,500 poles for gasoline lamps.

Jonesboro, Ind.—The purchase of new equipment for the electric light plant is contemplated, according to press reports.

Stillwater, Minn.—The question of establishing an electric light plant has been favorably voted on in South Stillwater.

Cleveland Heights, O.—Bids are asked until Nov. 6 for lighting several streets with gas or gasoline. W. G. Phare, vil. clk.

Santa Ana, Cal.—(Special.)—S. H. Finley, co. surv., says this city voted, Sept. 28, to issue $60,000 for municipal electric light plant.

Ft. Payne, Ala.—H. R. Godfrey has asked the mayor and board of aldermen for a franchise to construct and operate an electric light plant.

Moline, Ill.—The contract with the Peoples' Power Company for lighting this city expires Feb. 1, 1904, and plans for renewal are being considered.

Philadelphia, Pa.—The city council's electrical committee recommended, Oct. 13, an appropriation of $50,000 for new electric lights for next year.

Kenmore, N. Y.—(Special.)—A new gas company has been formed and a contract for drilling a well has been let to Simon P. Heasley of Bradford, Pa.; president, J. B. Ricker; secretary, John E. Middaugh, Jr.

Albany, N. Y.—Sealed bids are asked until 10 a. m. Nov. 12 for the reconstruction and repair of the electric plant, installing engines, generators, switchboard and branch steam and exhaust piping at the N. Y. State Soldiers and Sailors' Home, Bath, N. Y. O. H. Smith, secy. bd. trustees.

## GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Martins Ferry, O.—The question of a crematory will be voted on.

Muncie, Ind.—Extensive repairs to the city garbage plant are contemplated.

Logansport, Ind.—The contract for three years was awarded to Walter Beyer for $8,451.

Little Falls, N. Y.—A contract for garbage collection was awarded, Oct. 20, to Jas. Fitzgerald at $848 a year.

Austin, Tex.—An ordinance will be submitted to council providing for the construction of a garbage crematory.

Dayton, O.—Only one bid was received for disposing of garbage, dead animals, etc., and that was from the Dayton Sanitary Reduction Company.

Shamokin, Pa.—A proposition for erecting a crematory plant and phosphate factory two miles from this borough is being considered by the borough council.

## FIRE APPARATUS.

Jamestown, N. D.—A new hose tower is proposed.

Ithaca, N. Y.—A new hose cart will be purchased.

Saginaw, Mich.—A new steamer and fire boat is proposed.

Spencerport, N. Y.—The purchase of a new steamer is proposed.

Youngstown, O.—The fire committee has recommended the purchase of two steamers and 1,600 ft. of hose.

Culbertson, Mont.—The question of purchasing a chemical engine is being agitated by the citizens.

Santa Ana, Cal.—(Special)—S. H. Finley, county surveyor, says this city voted Sept. 28 to issue $8,000 bonds for fire apparatus.

## TOO LATE FOR CLASSIFICATION

Fremont, O.—The B. P. S. asked council Oct. 21 to amend the ordinance for paving W. State-st. with brick so as to include Trinidad or Bermudez asphalt.

South Manchester, Conn.—A petition is being circulated asking that Charter Oak-st. be macadamized.

Louisville, Ky.—Sealed bids will be received Nov. 6 for brick paving on Magnolia Hill, Twenty-eighth, Market and Levering-sts. and Gloss-ave.

Brooklyn, N. Y.—Bids were submitted Oct. 22 for grading and paving the Brooklyn Plaza of the Williamsburg bridge as follows: United Engineering and Construction Company, $98,745; R. H. Hood Company, $103,500.

San Antonio, Tex.—Sealed bids are asked until Nov. 19 for erecting a 50,000 gal. steel tank at Ft. Brown, Tex. T. E. True, C. Q. M.

St. Paul, Minn.—Bids will be received until Nov. 3 for 2,500 plain iron lamp-posts to be used by the city for street lighting purposes. Cy. Clk. Reddington.

New York City.—Sealed bids are asked until Nov. 5 for a steel superstructure of the Blackwells Island bridge (No. 4) over East river, between Manhattan and Queens boros.